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IMPROVED ANALYTIC LONGITUDINAL RESPONSE ANALYSIS FOR AXISYMMETRIC LAUNCH VEHICLES

VOLUME II - COMPUTER PROGRAM DESCRIPTION

by C. P. Rubin and T. T. Wang

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I. PROBLEM DESCRIPTION

This program uses an improved linear analytical model for the calculation of launch vehicle steady-state response to applied sinusoidal loads acting in the longitudinal direction. The present approach utilizes a finite element technique to construct the total launch vehicle stiffness [K] and mass [M] characteristics by subdividing the prototype structure into a consistent set of (1) axisymmetric shell components a_i to represent as separate units the fairing, interstage structure, bulkhead, tank walls and engine thrust structure; (2) fluid components b_i and (3) mass-spring components c_i to provide the inertial and stiffness characteristics of the equipment and engines and vehicle supporting structure.

The total vehicle characteristics are obtained by superposition of the stiffness and inertial characteristics of the individual shell, fluid and mass-spring components which are computed using a generalized coordinate approach. Fluid force and inertial coupling between all structural components is accomplished by assuming fluid motions consistent with the shell component distortions. The superposition technique automatically assures displacement compatibility and satisfies force equilibrium at the joints between components. After the complete system matrix has been formulated, displacement boundary conditions are introduced by removing appropriate rows and columns of matrix coefficients corresponding to points on the vehicle and its supports which are rigidly restrained from motion.

The coupled system natural frequencies and mode shapes are obtained from the eigenvalue equation constructed with the total stiffness and mass matrices

$$[K]\{\alpha\} - p^2 [M]\{\alpha\} = 0$$

in which p is the circular frequency of the system and $\{\alpha\}$ is the natural mode vector whose components are the longitudinal, radial and rotational displacements at discrete points on the vehicle. The steady-state response due to simple harmonic loads is determined using a standard modal response procedure which expresses the total displacement, velocity, acceleration and stress responses as the linear superposition of the individual modal responses based on an assumed modal damping.

II. PROGRAMMING ASPECTS

This section contains the following programming information:

1. Routine description
2. Tape format
3. Overlay program structure
4. Overlay core storage allocation
5. Deck set-up
6. Flow charts

ROUTINE DESCRIPTION

Name	Description
MAINF	Main program to generate program constants and to control the subprograms.
MATC	Matrix construction - Move B matrix into A matrix starting at $(i + 1)^{th}$ column and $(j + 1)^{th}$ row.
MATIV	Matrix inverse control - initialize and set up matrix for computing inverse.
MATO	Matrix clear - store zeros in matrix elements.
MAT1	Matrix transpose - $C = A^T$
MAT2	Matrix multiplication - $C = AB$
MAT3	Matrix addition - $C = A+B$
MAT5	Matrix multiplication - $C = AD$ where D is a diagonal matrix stored as a column.
MAT6	Matrix multiplication - $C = ADA^T$ where D is a diagonal matrix stored as a column.
MAT7	Matrix multiplication - $C = ADB$ where D is a diagonal matrix stored as a column.
MAT8	Matrix multiplication - $C = ADB^T$ where D is a diagonal matrix stored as a column.
MAT9	Matrix inverse - $C = A^{-1}$
MATP	Matrix print - print a rectangular matrix or the lower triangular portion of a symmetric matrix.
UNO9	Tape specification - generate FILE card for tape UNIT09.
UNO1	Tape specification - generate FILE card for tape UNIT01.
UNO2	Tape specification - generate FILE card for tape UNIT02.
BLDATA	Block data - generate $[\xi^n_{16}]$
BLDAT1	Block data - generate $[\dot{D}]$, $[W_G]$, $[\bar{\bar{W}}]$, and $[W]$
BLDAT2	Block data - generate $[\bar{W}]$
PRØC	Control program for reading input data and processing tables.

Name	Description
DASYS	Read system input data and save polynomial matrices on Tape 1.
DASH	Read shell input data and generate shell component tables.
DAFL	Read fluid component input data and store as a column in CØMMØN/DAS4/
DASM	Read spring-mass input data and save stiffness matrix $[K]_c$, mass matrix $[M]_c$, and identification vector on tape 2.
TABLE	Generate shell component tables which are functions of ξ at 16 points and compute initial stresses. Save processed data and geometry data on Tape 3 and Tape 4, respectively.
FUN2	Function subprogram to compute a part of initial stress.
FINP	Input subroutine. See separate write-up for further description.
SCNTL	Control program for generating stiffness matrix $[K]_a$ and mass matrix $[M]_a$ for shell components. These matrices are saved, along with the I.D. vector, on Tape 2. Transformation matrix [T] is saved on Tape 9.
CØMPK	Compute 13 diagonal matrices which are functions of ξ and store results in CØMMØN/WØRK/
GENKM	Generate stiffness matrix $[K]_a$ and mass matrix $[M]_a$ for a shell component.
GENUV	Compute matrix [UV]
FCNTL	Control program for generating mass matrix for fluid components. These matrices are saved, along with the I.D. vector, on Tape 2.
GENXI	Generate matrices $[\xi]_{a1}$, $[\xi]_{a2}$, $[\xi]_{a3}$, $[\bar{\xi}]_{a2}$ or $[\bar{\bar{\xi}}]_{a2}$; $[\xi_{10} - \xi_{11}]$, $(\xi_{20} - \xi_{21})$, $(\xi_{30} - \xi_{31})$; γ_1, γ_2 and γ_3.
TABL1	Generate tables that are evaluated at 21 points of ξ.
DIAGM	Compute 35 diagonal matrices that are used in generating matrices $[\bar{M}_1]$ and $[\bar{M}_2]$.
GENFM	Generate matrix $[\bar{M}]$ for a fluid component.
VVV	Subroutine to compute $[\bar{V}_k^1]$, $[\bar{V}_k^2]$, $[\bar{V}_k^3]$, $[\bar{\bar{V}}_k^1]$, or $[\bar{\bar{V}}_k^3]$

Name	Description
WWW	Compute the sum of three terms in matrix $[\bar{M}_2]$ for case 2 or case 3.
YYY	Compute the sum of two terms in matrix $[\bar{M}_1]$ and $[\bar{M}_2]$
GENMB	Compute mass matrix $[M]_b$ for a fluid component.
TØTKM	Control program to generate total stiffness matrix [K] and total mass matrix [M] from component matrices. [K] and [M] are saved on Tape 4 and Tape 3, respectively.
BUILD	Subroutine to build a part of a total matrix from a component matrix and I.D. vector.
EGCNT	Control program to compute natural frequencies and mode shapes. The system data required for response computation is saved on Tape 1.
FREQ	Compute and print natural frequencies, mode shapes, velocities, and accelerations. Natural frequencies and mode shapes are saved on Tape 1.
EG2FM	Subroutine to compute eigenvalues and corresponding eigenvectors. See separate write-up for further description.
RCNTL	Control program to compute steady-state response. Data is taken from Tape 1 and Tape 2.
RESP1	Compute and print response amplitudes and phase angles.
STRES	Compute and print component force amplitudes and phase angles.

Identification

RW FINP - Decimal, Octal, BCD, Variable Data Input

Purpose

To read a set of Hollerith punched data and/or header cards into core with one CALL statement.

To convert the data fields to binary and store in core according to their associated conversion codes.

Restrictions

This routine uses FRWD to accomplish the BCD card image read and write. *

This routine uses FXEM error code 60 in case of errors such as non-Hollerith characters, data out of range, illegal format, subscripts too large for the array previously defined, etc. Upon detection of any error, control is sent to FXEM after the end-of-case is encountered. *

Method

Decimal numbers are converted to binary integers and then scaled to the indicated power of ten.

Octal numbers are converted to binary integers.

Hollerith words are stored directly.

Range: Decimal to floating binary conversion $10^{\pm 38}$
Decimal to fixed binary; 1 to 9 digits**
Decimal integer to binary integer; 0 to $2^{35} - 1$
Octal integer to binary integer; 0 to $2^{35} - 1$

Card images are optionally listed as encountered. If cards are listed, a page is ejected before listing the first card image. *

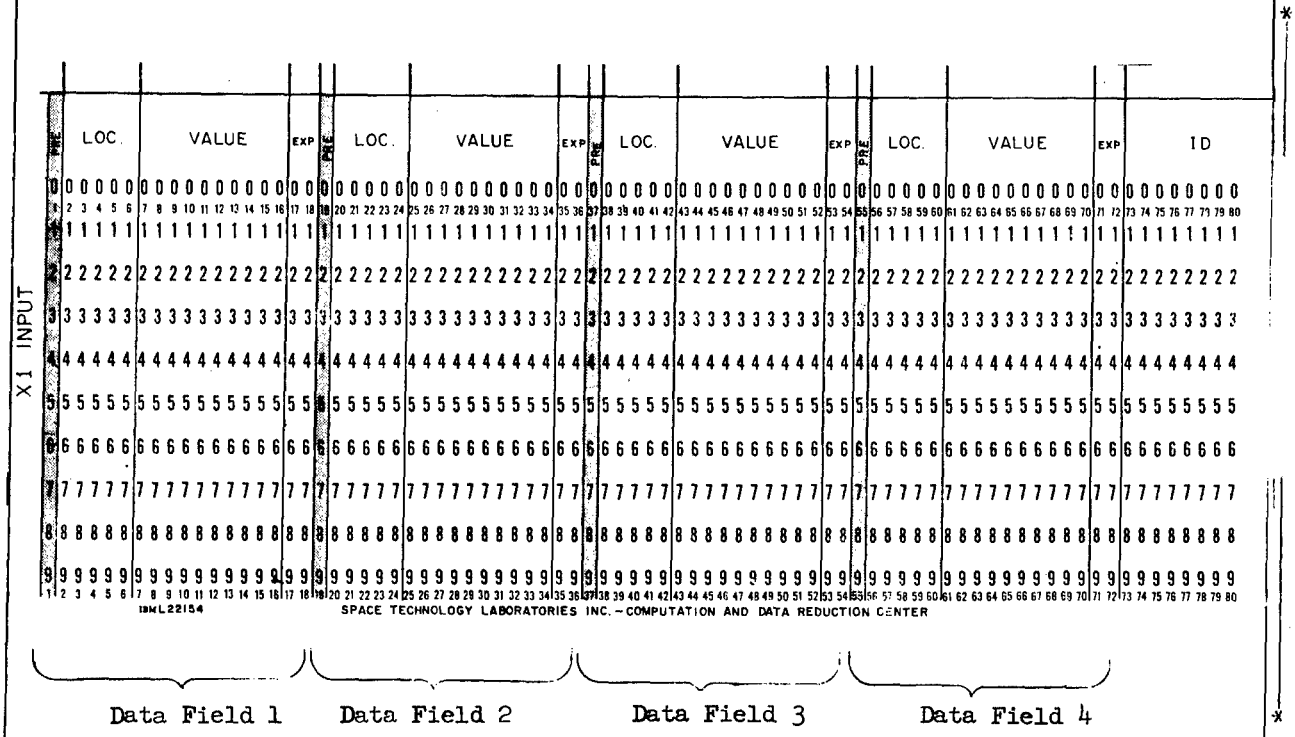
**The magnitude of the number depends upon the location of the decimal point.

Usage:

Format:

1. The data card format, available on keypunch form X1, X2, or X3, consists of four subfields containing the conversion code, location, number and exponent respectively.

	Card Columns			
	Data Field	Data Field	Data Field	Data Field
Sub field	1	2	3	4
Conversion code	1	19	37	55
Location	2-6	20-24	38-42	56-60
Value	7-16	25-34	43-52	61-70
Exponent	17-18	35-36	53-54	71-72



where conversion code is one of the alphabetic characters defined below which specifies the type of conversion to be used on the value field, the location specifies the cell into which the converted value field is to be stored, the value subfield contains the data to be converted, and the exponent contains the power of ten by which floating data is to be scaled, or the location of the binary point of fixed point data.

2. The header card format consists of a conversion code in column 1, a sequence number or symbolic location in columns 2-6 and any Hollerith information in columns 7-72. *

Decimal Points:

Decimal points may be placed anywhere in the value field except that they may not occur in the same column as a minus sign (11 punch) since this results in a non-Hollerith character. If the decimal point would normally appear at the right of the number punched in the value field, then it is optional.

Minus Signs:

Minus signs are 11 punches over any digit of the field. If all of the available columns of the field are not used, minus signs may be punched as the left character of the field.

Values:

Values must always be written to the extreme left of a field. It is not necessary that the entire field be filled as the first blank denotes the end of value. Superfluous low order zeros should be omitted as they increase conversion error.

The only exception to partial fields is BCI data where the entire field, including blanks, is stored.

Location:

The location may be specified by either absolute octal, a variable or array name, or the element subscripts in a one or two dimensional array. If the locations contain five digits, it is interpreted as octal. All five columns must be punched for octal locations.

If the location contains at least one (1) non-numeric character, it is interpreted as a variable or array name which must appear exactly as given in the CALL statement (see Calling Sequence below). The contents of the number and exponent fields, if they are numeric data, are stored in the cell for the variable or the first cell for the array. This location then becomes the origin for all subscript locations following until another variable or array name is encountered. Caution must be taken to load an array name prior to subscript locations.

If the location contains four or fewer digits, it is interpreted as a subscript except for conversion code H explained below. Single dimension array subscripts must be left justified with leading zeros optional. Two dimension array subscripts must be denoted by two subfields containing i and j respectively. The i and j subfields must be separated by a comma. Each subfield may be 1 to 3 digits but the total field, including the comma, cannot exceed 5 characters.

If the location is left blank, then the location counter within the routine is increased by 1 and the associated number is stored in the cell immediately following the cell where the last number was stored. Thus, an entire array may be read in by specifying the initial location only.

Conversion Codes:

Blank: Floating decimal

The number in the value field times the power of ten in the exponent field is converted to floating binary. Checks are made for overflow and format errors.

F: Fixed decimal

The number in the value field is converted to fixed point binary and stored with the binary point located at the position specified by the number in the exponent field. An overflow error check is made.

I: Decimal integer

The number in the value field is converted to a fixed point binary integer with the binary point following position 35. The exponent field is ignored. A decimal point is considered an error.

B: Octal

The value plus exponent fields are converted as a logical octal word.

It is not necessary to include leading zeros but the first octal digit must always occupy the leftmost position of the field.

D: BCI Data

The contents of the value plus exponent fields are interpreted as two BCI words and stored in two consecutive cells whose origin is specified by the location field.

H: Heading card

A card with an H in column 1 is considered a BCI heading card. If the location field is blank, the card is ignored. If the location field contains a one to four digit positive decimal integer V, (octal, or negative values not permitted) columns 7-72 of the card are stored directly in 11 consecutive words beginning at the current origin +11 * (V-1). If the location field is symbolic it becomes the current origin and is equivalent to V=1.

The last variable or array named in the CALL statement is used to initialize the current origin so that symbols are not required on headers which are first in the deck. Each card may be used as one record of output using FØRMAT option A with column 7 of the card providing the code for printer spacing.

A: Variable names as data

The value plus exponent fields are interpreted in a pseudo MAP instruction format AAAAA T DDDDD P where the fields to replace are address, tag, decrement and prefix respectively. The address and decrement fields are defined normally to be 5 characters and the tag and prefix as one octal numeric character each. Any field containing less than the normal number of characters must end with a comma while fields of normal length must not. Any address or decrement field containing less than 5 numeric characters is converted as decimal while those of all 5 numeric characters are converted as octal. Any address or decrement field containing at least one non-numeric character is interpreted as a variable or array name. Variable addresses cause the entire word from the compiler generated calling sequence to be loaded into the location word (i.e., the PZE X is stored in the location specified if X is the variable appearing in the address field). Variable decrements cause the right-most 18 bits from the compiler generated calling sequence to be loaded into the prefix and decrement of the location word. Numeric tags and prefixes are loaded directly into the corresponding parts of the location words. Null fields are not loaded. The first blank indicates the end of the loading; the address only, the address-tag, the address-tag-decrement, or the entire word may be loaded as desired.

G: Temporary Origin

The value in the first location field on the card is used as a temporary origin for tables. The location is saved and if data cards follow with blank location fields the corresponding data is stored consecutively beginning with the cell specified in the location in the G card. Columns 7-72 are ignored and may be used to identify the table.

The first non-blank location starts a new origin. If this non-blank location is a subscript, it references the last variable or array named, which may or may not have been on the G card.

J: Halt and Jump *

The location specified with this prefix must be an octal address and is the only part of the data field that is interpreted. The subroutine causes a transfer to the octal location specified and does not interpret the remaining fields on the card.

L: Two dimension array i_{max}, j_{max} definition

The location field contains the name of the array to be loaded. The value field is defined to consist of 2 subfields, separated by a comma, containing the decimal integers for i_{max} and j_{max} respectively where i_{max} and j_{max} generally appear in a DIMENSION statement. Until redefined the i_{max} and j_{max} values are retained to compute the successive subscripted locations. Blank address fields may follow this array definition if successive elements of the array are to be loaded.

M: Two dimension array i_{max}, j_{max} definition

Conversion is identical to L except the entire array is preset to zero.

E: End case

This defines an end-of-case and control is returned to the FORTRAN object program. The rest of this field and the remaining fields on the card are ignored.

K: Omit loading the next N cells

The integer N in the value field is used to increment the next storage location by N.

C: Preserve the location of the next storage cell.

The location of the next available sequential storage cell is stored into the TABLE of symbolic information in the address of the word in the calling sequence corresponding to the word which contains the BCI representation of the symbol in the value field.

R: Retain base location

The location of the symbol in the value field is saved as a base location for relative addressing. The base is initialized to the last variable or array in the calling sequence.

N: Preserve the relative location of the next storage cell.

In addition to the function of the C code being performed the location of the next available sequential storage cell relative to the symbol defined by the last R code will be stored according to the next table entry. The next symbol in the TABLE will be checked for being null (all blanks). If it is, the relative location (index value) will be stored in the associated location. If the symbol is not null an error is noted.

Calling Sequence:

The following two types of CALL statements may be used:

I. CALL FINP (± n,X,Y,ZETA,...,mHX (5) Y (5) ZETA (2)...) where *

A. n is the number of variables and/or arrays in the list, excluding n itself. If n is negative, a card image listing is produced and if n is positive, no listing is provided.

B. X, Y, ZETA,... are the names of variables and/or arrays restricted to at most 5 characters each, one character of which is non-numeric.

C. m is 6 times n. Hence, mH allows for 6n Hollerith characters to follow.

D. X (5) Y (5) ZETA (2)... is a list of the items previously named in exactly the same order with (i) indicating the number, i, of blanks necessary to provide six Hollerith characters for each item. Since each item name is restricted to 5 characters, the minimum value of of (i) is (1).

II. CALL FINP (0) where the number of items is given as zero. This CALL statement must be used only after a CALL statement of type I has been executed. When the subroutine encounters a zero for the number of items, it immediately refers to the last executed CALL FINP with a

non-zero number of items for the names of the items to be loaded.

Space Requirements

776 cells

Identification

RW EG2F Eigenvalues & Eigenvectors of $Ax = \lambda Bx$

Purpose

To compute in single precision floating point all the eigenvalues and eigenvectors of the (real) system $Ax = \lambda Bx$, where A and B are symmetric, and B is positive definite. The computation of the eigenvectors is optional.

Restrictions

No internal checks are made for overflow or underflow. The eigenvectors are not normalized. The matrices A and B are destroyed by the subroutine. The size of the system is limited only by the amount of core storage available.

Method

A lower triangular matrix M^{-T} is found such that $B = M^{T}M$. The equation $Ax = \lambda Bx$ is then equivalent to $M^{-T}AM^{-1}Mx = \lambda Mx$. We form the symmetric matrix $F = M^{-T}AM,^{-1}$ and let $y = Mx$. Now we solve the standard eigenvalue problem $Fy = \lambda y$ using the Jacobi method routine NYEVV, which gives us the desired eigenvalues. The eigenvectors are found by forming $x = M^{-1}y$. Details of the decomposition, $B = M^{T}M$, are given in Appendix A of routine RW MI2F.

Usage

Calling Sequence:

Loc.	Oper.	Add, Tag, Decr..
α	TSX	EG2F, 4
$\alpha + 1$	PZE MZE	A, 0, B
$\alpha + 2$	PZE	V, 0, N
$\alpha + 3$	Error Return	
$\alpha + 4$	Normal Return	

Where:

Operation of $\alpha + 1$ is $\begin{pmatrix}\text{PZE}\\ \text{MZE}\end{pmatrix}$, if eigenvectors $\begin{pmatrix}\text{are}\\ \text{are not}\end{pmatrix}$ desired.

A is the first location of N^2 cells which contain the full A matrix upon entrance. The eigenvalues will be stored along the main diagonal upon exit.

B is the first location of $(N^2 + N)/2$ cells containing the lower triangular portion of the B matrix. That is, $C(B) = b_{11}$, $C(B+1) = b_{21}$, $C(B+2) = b_{22}$, $C(B+3) = b_{31}$, etc.

Usage (continued)

V is the first location of N^2 cells which will contain the eigenvectors stored row-wise upon exit. The ith row of this matrix is the eigenvector corresponding to the ith eigenvalue along the main diagonal of the matrix which has replaced the A matrix.

If eigenvectors are not desired, V is the first location of N^2 cells used for temporary storage.

N is the order of the system.

Error return may be reached from two sources:

a) If C(ACC) = 0, the matrix B is not positive definite.

b) If C(ACC) $\neq$ 0, the matrix F is ill-conditioned under the criterion described in NYEVV as "restriction 1".

Coding Information

A square root routine (RWSQ2F) begins at EG2F + 345.
A Jacobi method routine (NYEVV) begins at EG2F + 370.
M^{-T} was formed by RWMI2F which begins at EG2F + 216.

Space Requirements

Program - 706 cells
CØMMØN - (14+N) cells

Timing

Approximately $.005N^3$ seconds, if eigenvectors are desired, or $.0035N^3$ seconds, if eigenvectors are not desired.

TAPE FORMAT

Five tapes are used to store intermediate results, to transmit data between program links, and to save information for computing steady-state response. The following is a general description of the contents of each tape:

Tape #1

This tape is used as a scratch tape in subprogram DASYS to store the polynomial matrices $[A]_k$ and $[B]_k$ which will be used in subprograms SCNTL and FCNTL to compute the component stiffness matrix and mass matrix. It contains $2 \times N_P$ number of records as shown:

$\bar{U}_k$, $\bar{V}_k$	$[A]_k$ $[B]_k$	$k = 1,2,3, \ldots, N_P$

Subprograms EGCNT and FREQ regenerate tape 1 to be saved for steady-state response computation. It contains four records:

Record No. 1 - Processed response data that are stored in CØMMØN/SYSO/:
HHEAD, P_i, C_i, η_k, N_{ET}, f_i, Δf_i, m_i

Record No. 2 - System input data that are stored in CØMMØN/SYS1/:
N_C, N_S, N_F, N_M, S, N_O, N_L, N_P, g, N_{EI}

N_W, opt_1, opt_2, opt_3, and opt_4.

Record No. 3 - Natural frequencies p_k in radians per second.

Record No. 4 - Mode shapes $\{\alpha_{ik}\}$

Tape #2

This tape contains the stiffness and mass matrices of all the individual components for constructing the total stiffness matrix and mass matrix and for computing steady-state response. It is generated by subprograms DASM, SCNTL and FCNTL in the following order:

1. Spring-mass I.D. number, matrix dimension, I.D. vector, stiffness matrix and mass matrix (2 x N_M records):

c_i, n_i	$(IDC)_i$, $[K_c]_i$, $[M_c]_i$	$i = 1,2,3, \ldots, N_M$

2. Shell component I.D. number, matrix dimension, I.D. vector, stiffness matrix and mass matrix (2 x N_S records):

a_i, $(\bar{U}+\bar{V})_i$	$(ID)_i$ $[K_a]_i$, $[M_a]_i$	$i = 1,2,3, \ldots, N_S$

3. Fluid component I.D. number, matrix dimension, I.D. vector, and mass matrix (2 x N_F records):

b_i, $\Sigma(\bar{U}+\bar{V})_i$	$(ID_{a1})_i$, $(ID_{a2})_i$, $(ID_{a3})_i$, $[M_b]_i$	$i = 1,2,3,\ldots, N_F$

Tape #3

This tape is used to transmit the processed shell data from subprogram TABLE in link 1 to subprogram SCNTL in link 2. It contains 3 x N_S number of records:

a_i, $ITEM_i$	$(DAS1)_i$	$(DAS2)_i$	$i = 1,2,3, \ldots, N_S$

Record No. 1 - a is the shell I.D. number and ITEM, equal to seven, is the number of tables in record no. 2.

Record No. 2 - Seven processed shell tables and three computed constants that are stored in CØMMØN/DAS1/:

ϕ, r, r_2, r, N_ϕ, t, and D

k, d_1 and d_2

Record No. 3 - Processed tables of shell orthotropic constants that are stored in CØMMØN/DAS2/:

C11, C12, C22, C33, C34 and C44.

Tape 3 is utilized again in subprogram TØTKM to store the dimension $N_C - N_O$ and the total mass matrix [M] as record no. 1 and record no. 2, respectively. The total mass matrix is saved for the computation of natural frequencies in subprogram EGCNT.

Tape #4

This tape is used to save the shell input data generated in subprogram TABLE to be used in subprogram SCNTL. Each record contains shell input data that is stored in CØMMØN/DAS0/. The table contains a total of N_S records.

Tape 4 is utilized again in subprogram TØTKM to store the dimension $N_C - N_O$ and the total stiffness matrix [K] as record no. 1 and record no. 2, respectively. The total stiffness matrix is saved for the computation of natural frequencies is subprogram EGCNT.

Tape #9

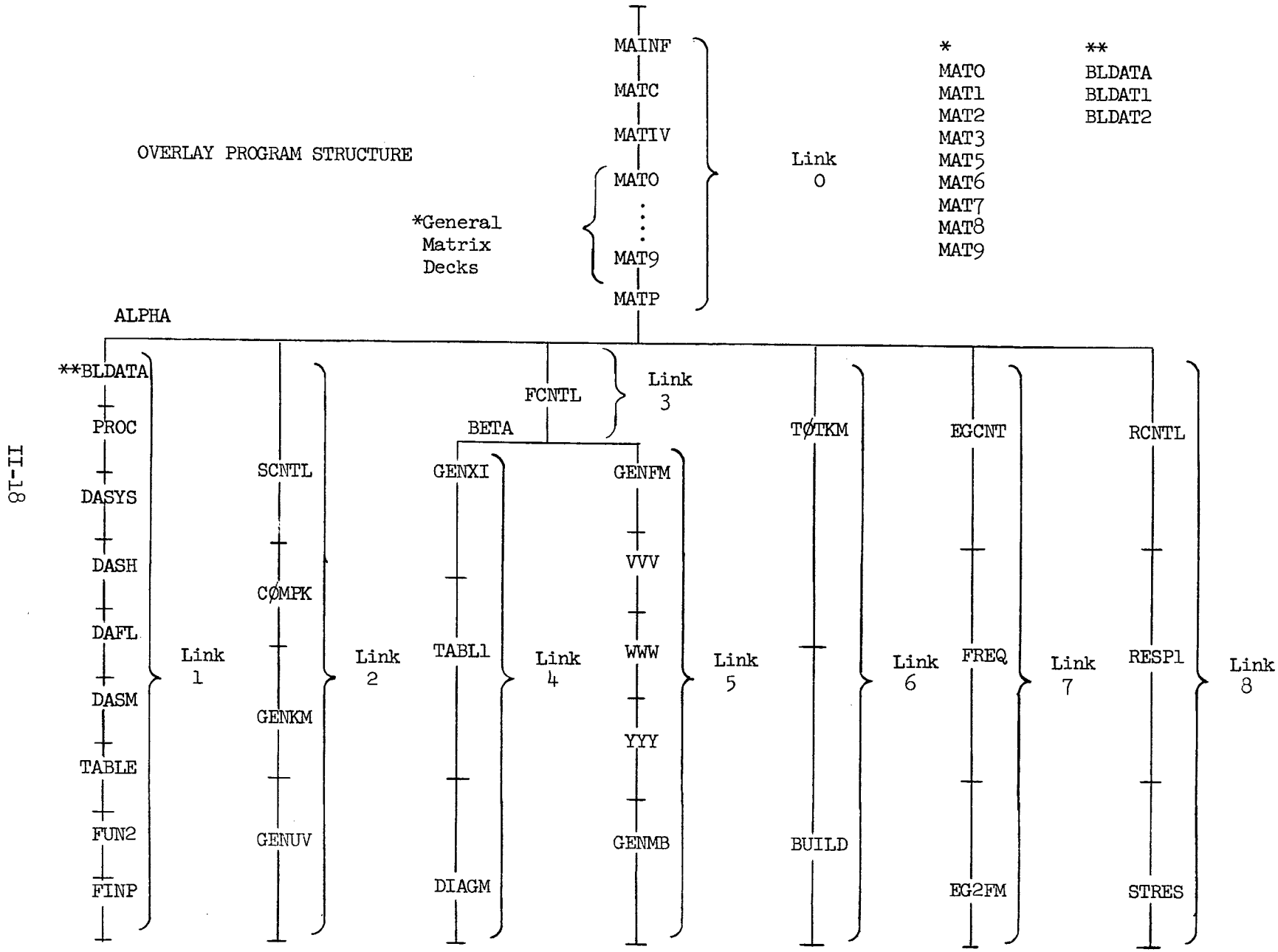
Tape 9 is used to store the shell component transformation matrices which are generated in subprogram GENKM and to be used in subprogram FCNTL. It contains two records per shell component as shown:

a_i, $(\bar{U}+\bar{V})_i$	$[T]_i$	i = 1,2,3, ..., N_S

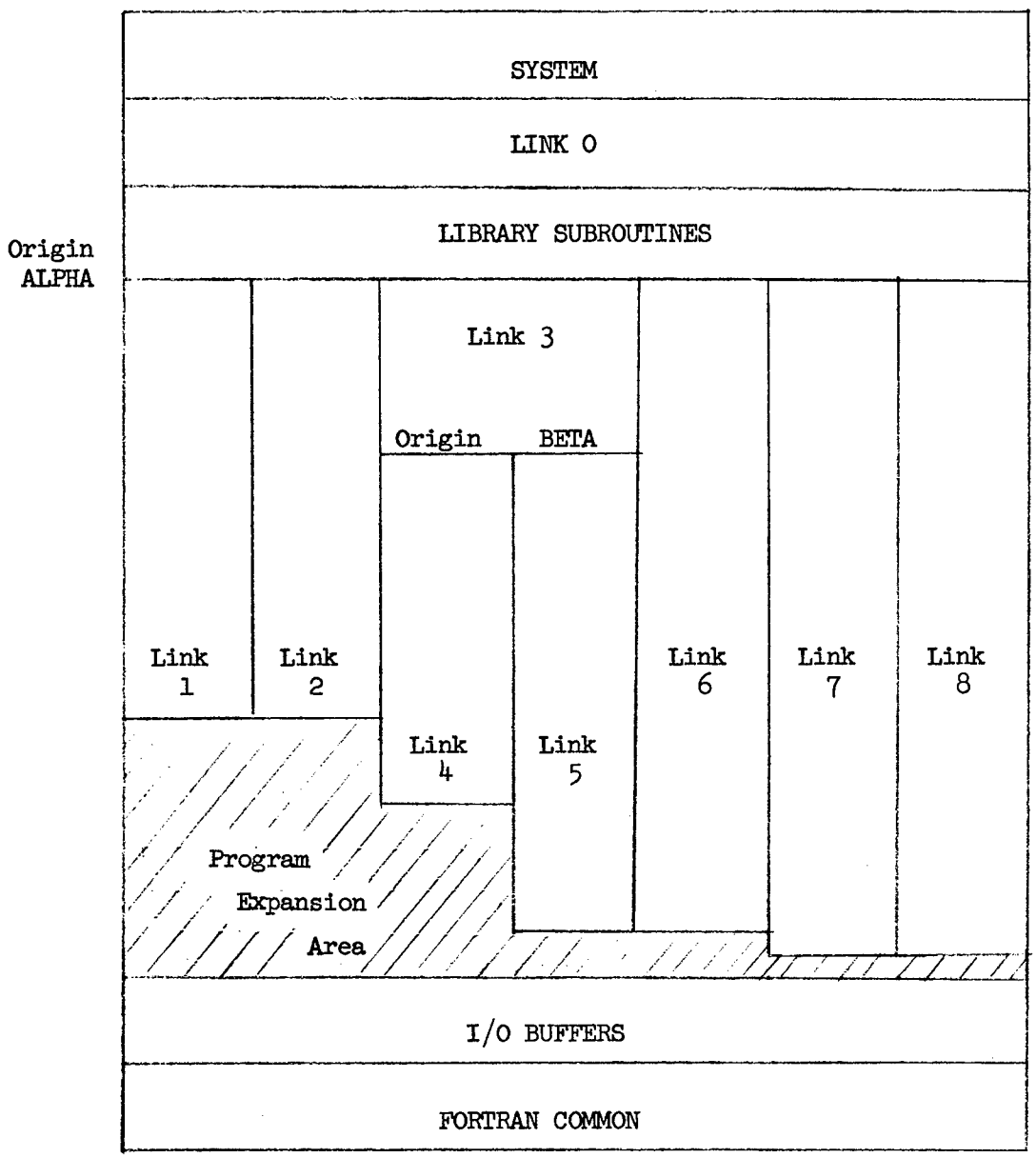
where a is the shell component I.D. number

$\bar{U}+\bar{V}$ is the dimension of matrix [T]

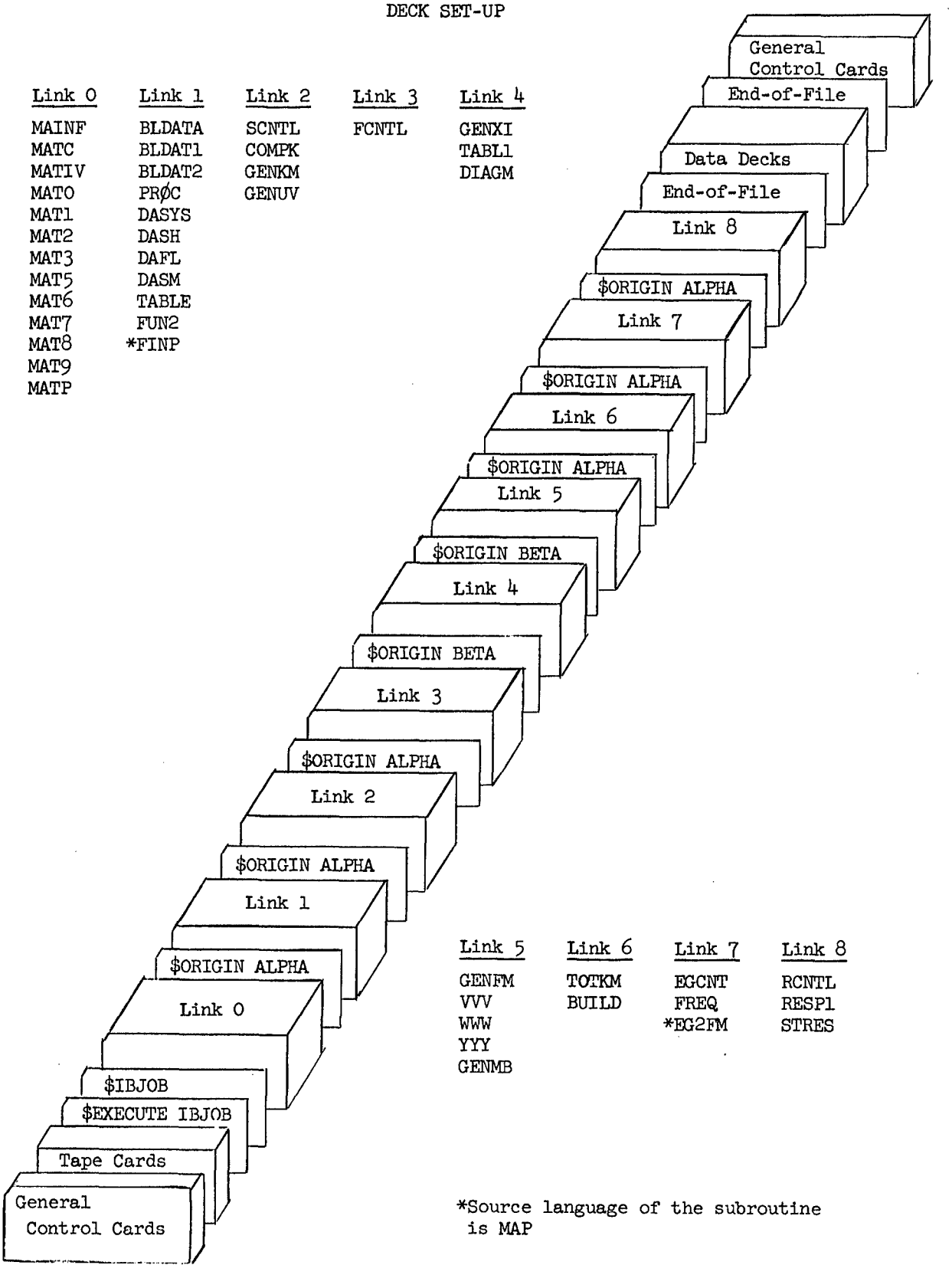
[T] is the transformation matrix.


OVERLAY PROGRAM STRUCTURE
MAINF
MATC
MATIV
MATO
MAT9
MATP
*General Matrix Decks
Link 0
*
MATO
MAT1
MAT2
MAT3
MAT5
MAT6
MAT7
MAT8
MAT9
**
BLDATA
BLDAT1
BLDAT2
ALPHA
**BLDATA
PROC
DASYS
DASH
DAFL
DASM
TABLE
FUN2
FINP
Link 1
SCNTL
CØMPK
GENKM
GENUV
Link 2
FCNTL
Link 3
BETA
GENXI
TABL1
DIAGM
Link 4
GENFM
VVV
WWW
YYY
GENMB
Link 5
TØTKM
BUILD
Link 6
EGCNT
FREQ
EG2FM
Link 7
RCNTL
RESP1
STRES
Link 8

OVERLAY CORE STORAGE ALLOCATION



DECK SET-UP



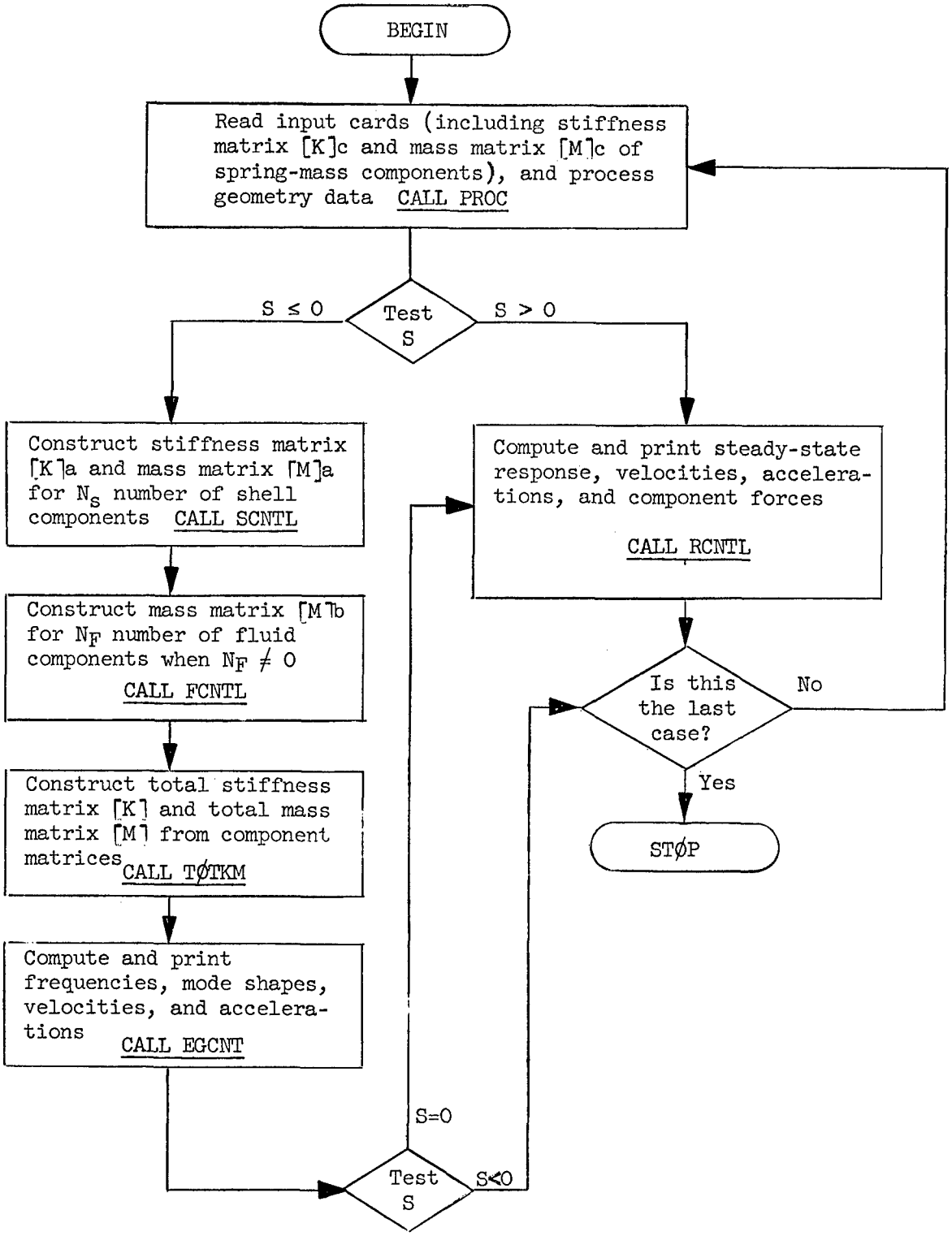
Link 0	Link 1	Link 2	Link 3	Link 4
MAINF	BLDATA	SCNTL	FCNTL	GENXI
MATC	BLDAT1	COMPK		TABL1
MATIV	BLDAT2	GENKM		DIAGM
MATO	PRØC	GENUV		
MAT1	DASYS			
MAT2	DASH			
MAT3	DAFL			
MAT5	DASM			
MAT6	TABLE			
MAT7	FUN2			
MAT8	*FINP			
MAT9				
MATP				

Link 5	Link 6	Link 7	Link 8
GENFM	TOTKM	EGCNT	RCNTL
VVV	BUILD	FREQ	RESP1
WWW		*EG2FM	STRES
YYY			
GENMB			

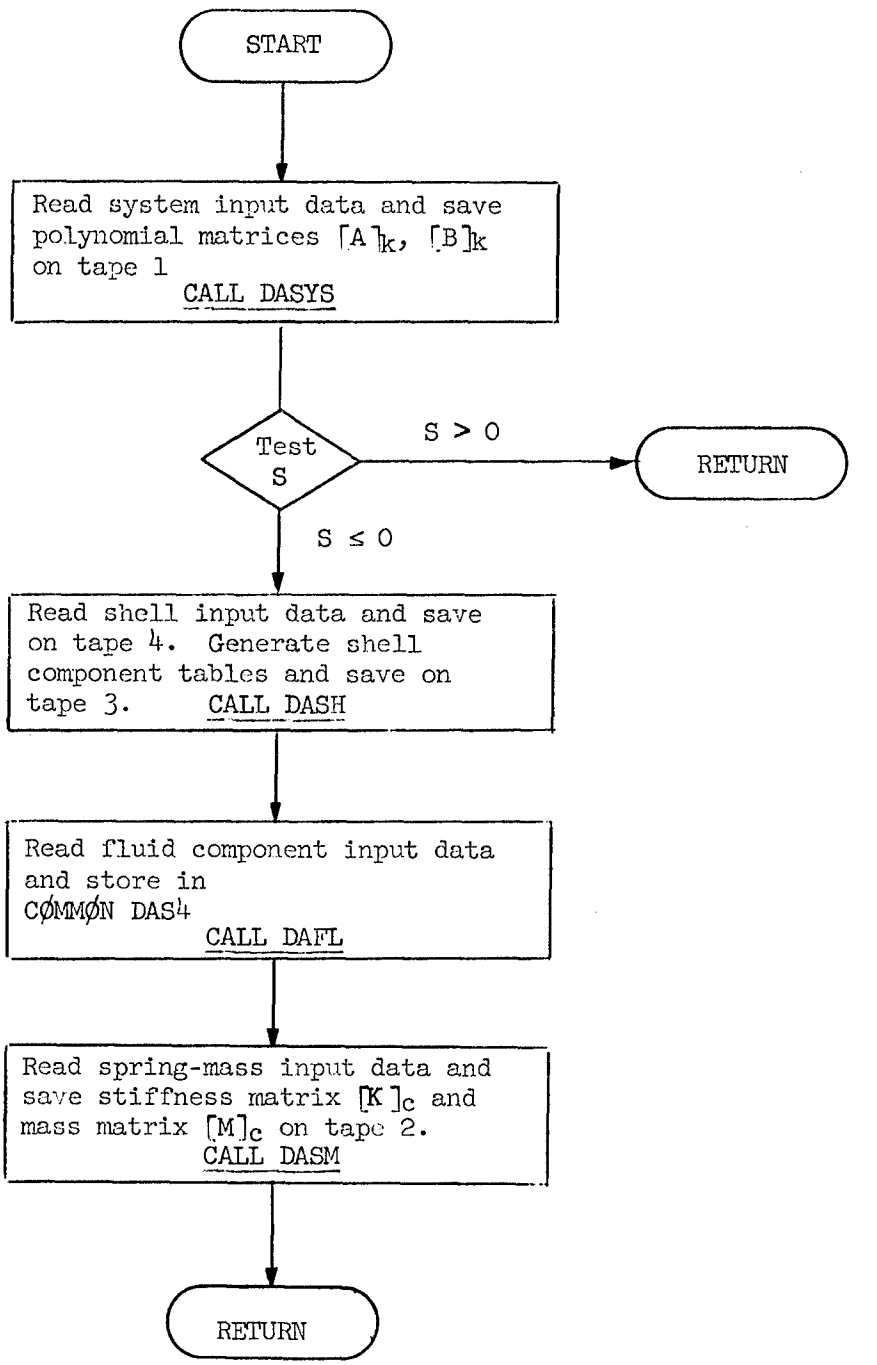
*Source language of the subroutine is MAP

MAINF

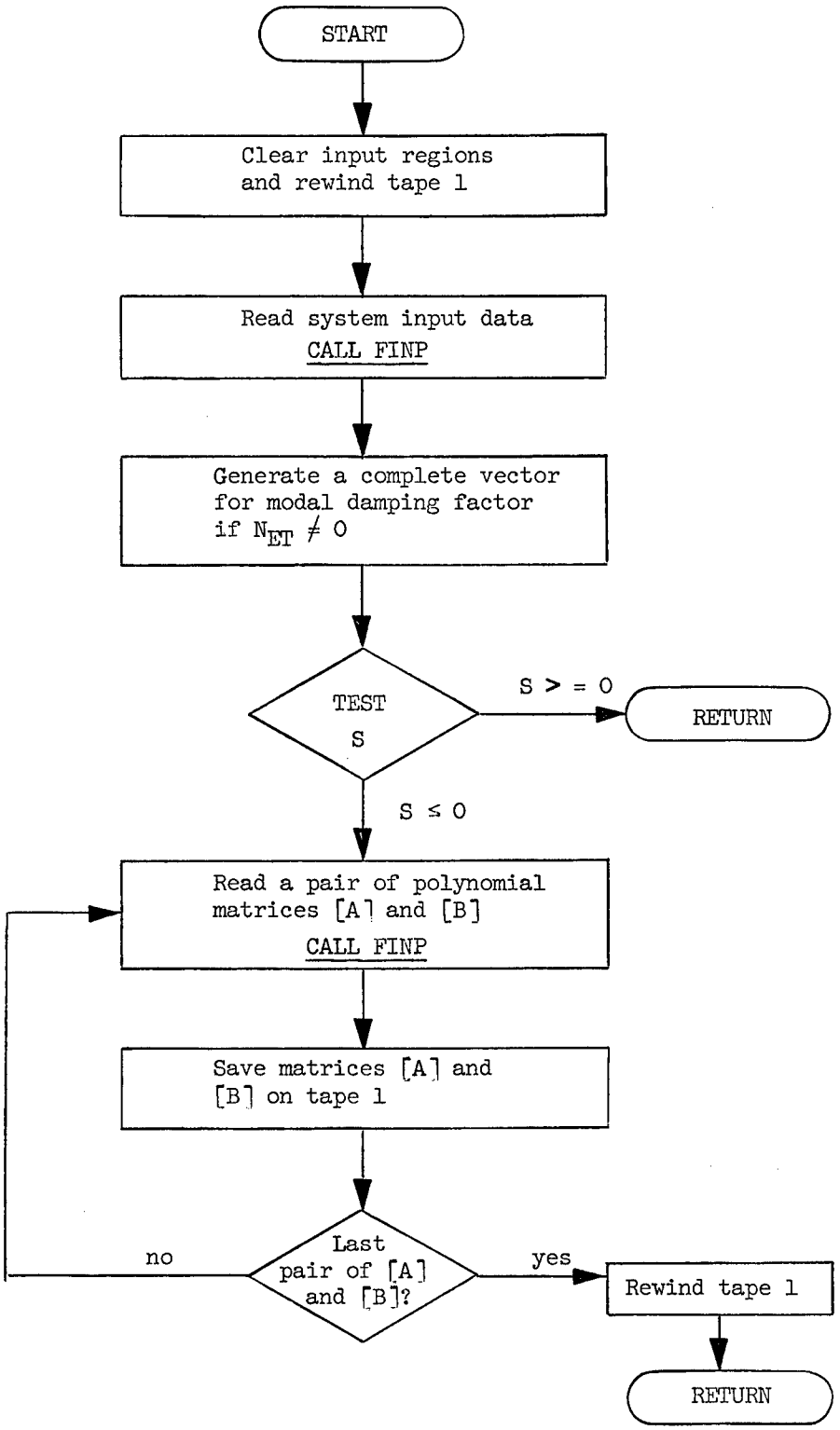
MAIN CONTROL PROGRAM



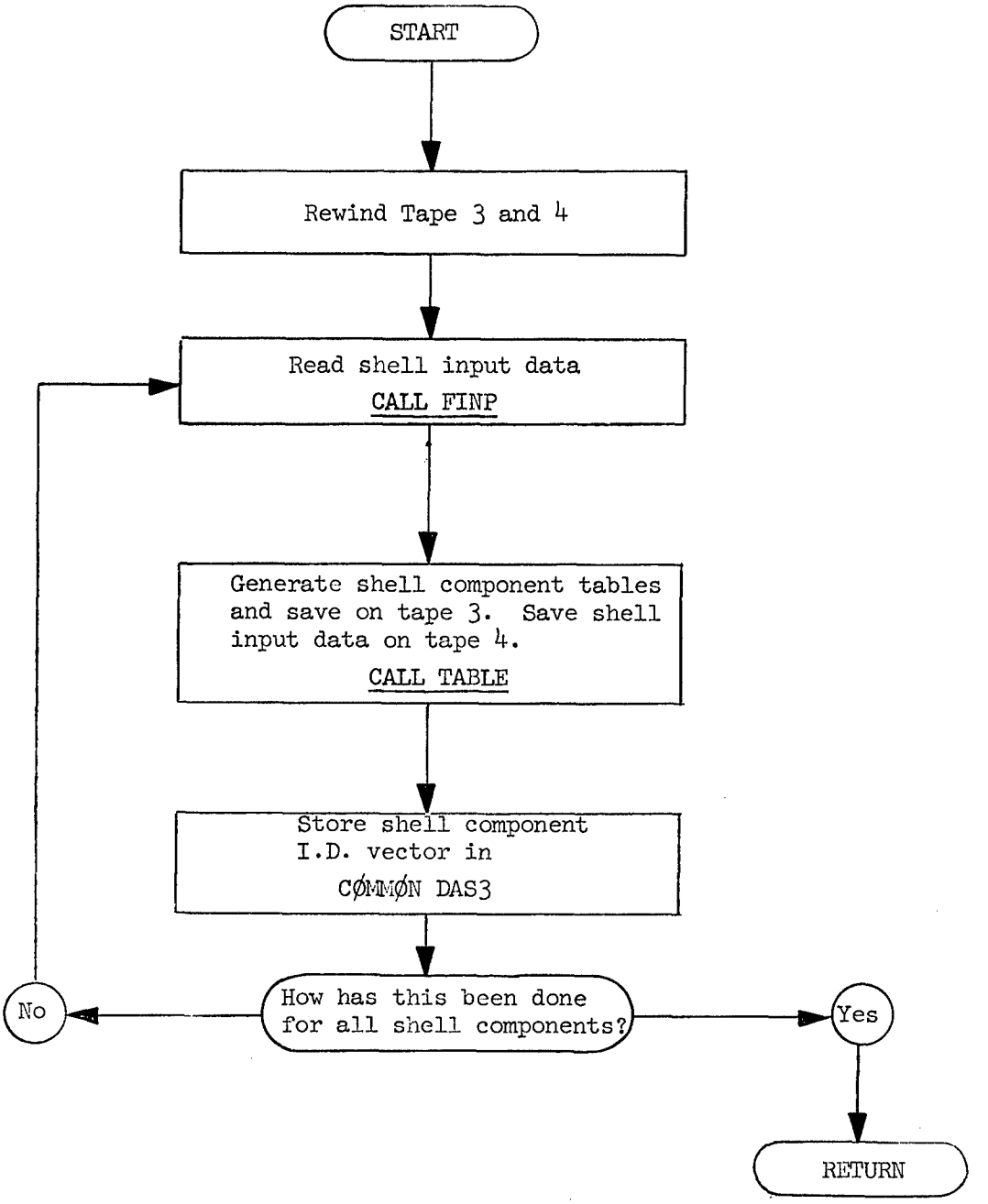
PRØC CONTROL PROGRAM FOR DATA INPUT AND PROCESSING



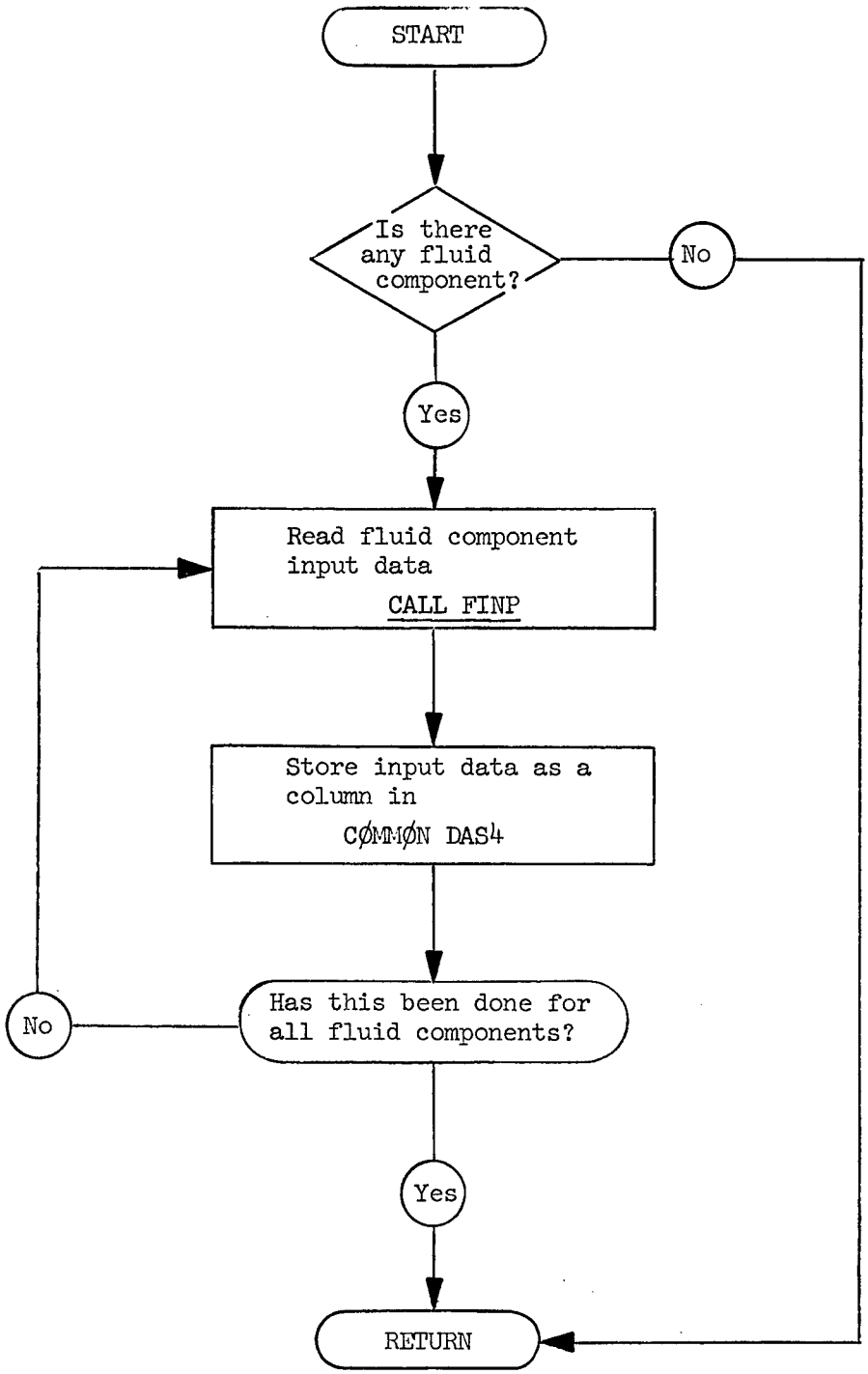
READ SYSTEM INPUT DATA AND SAVE POLYNOMIAL MATRICES ON TAPE 1

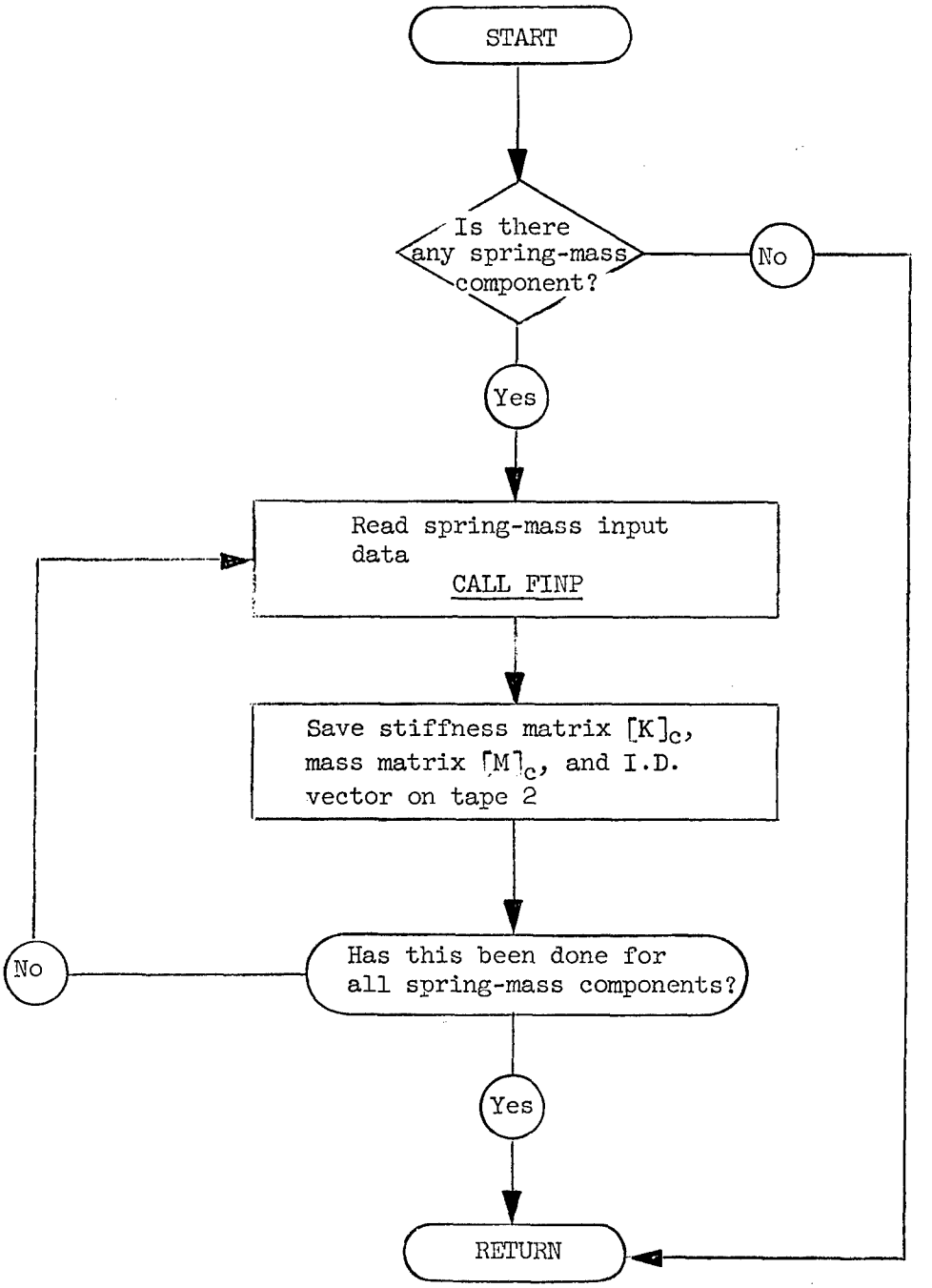


READ SHELL INPUT DATA AND
GENERATE SHELL COMPONENT TABLES



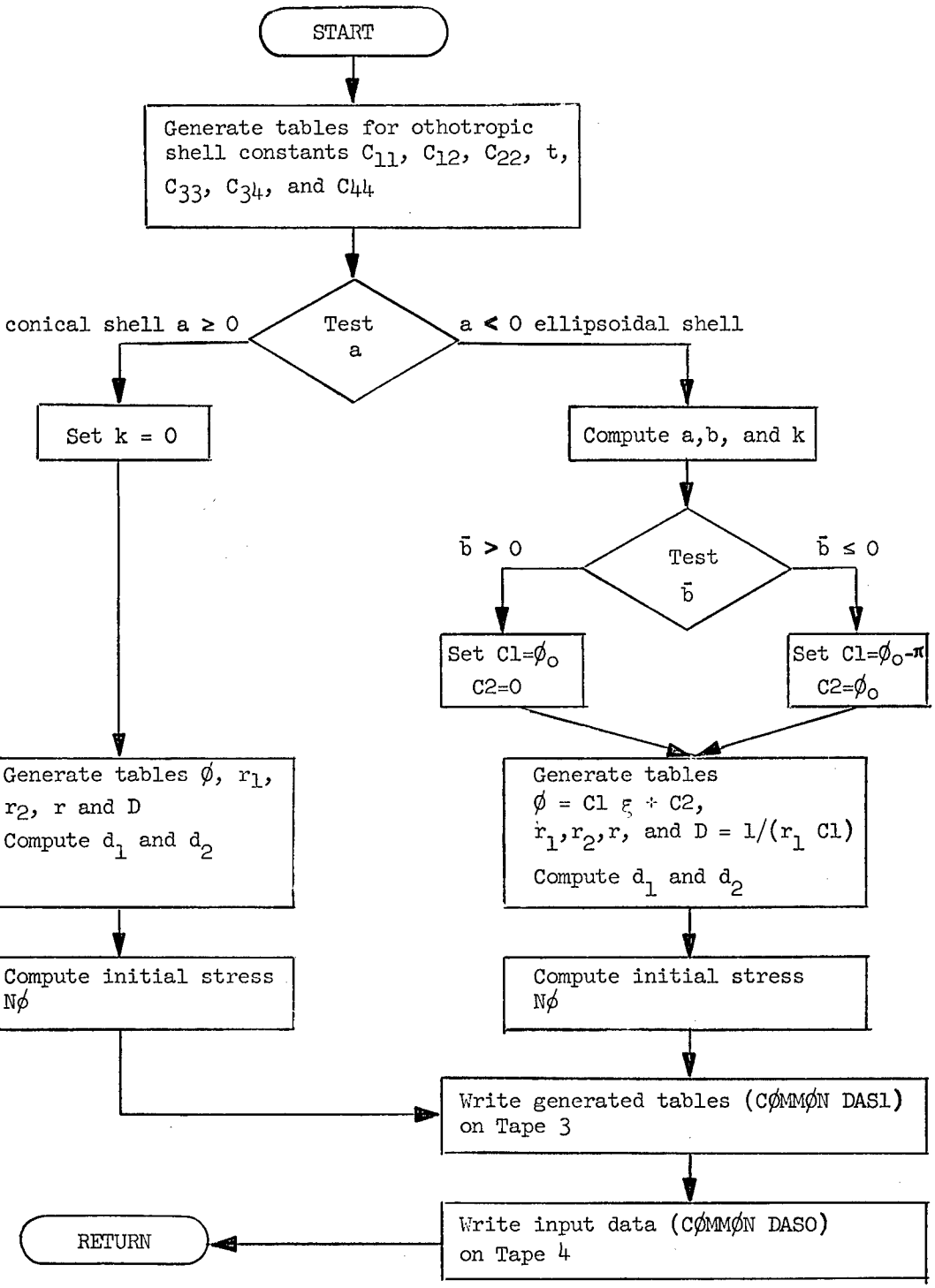
READ FLUID COMPONENT INPUT DATA



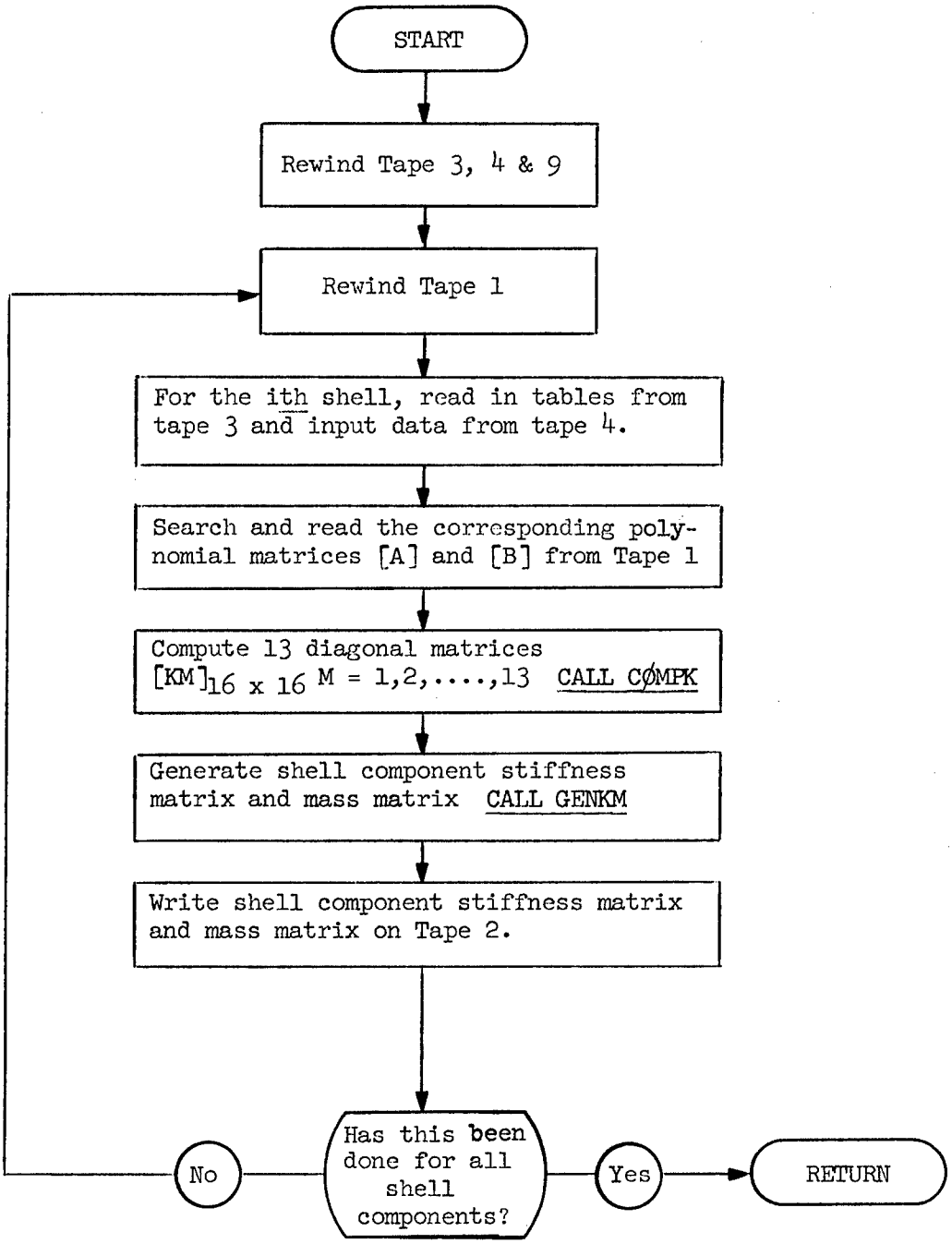

START
Is there any spring-mass component?
No
Yes
Read spring-mass input data
CALL FINP
Save stiffness matrix [K]c, mass matrix [M]c, and I.D. vector on tape 2
Has this been done for all spring-mass components?
No
Yes
RETURN

TABLE

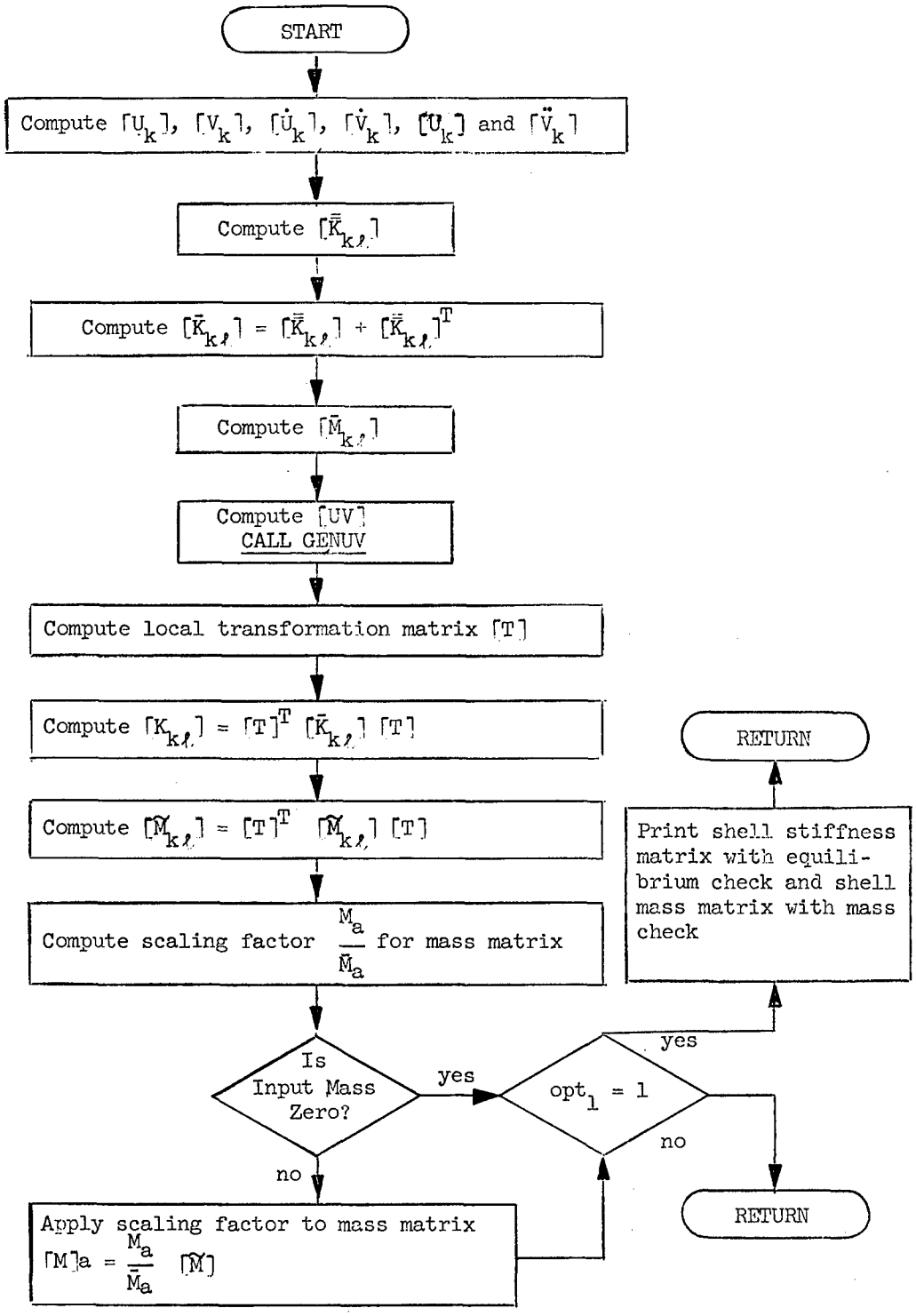
GENERATE SHELL COMPONENT TABLES



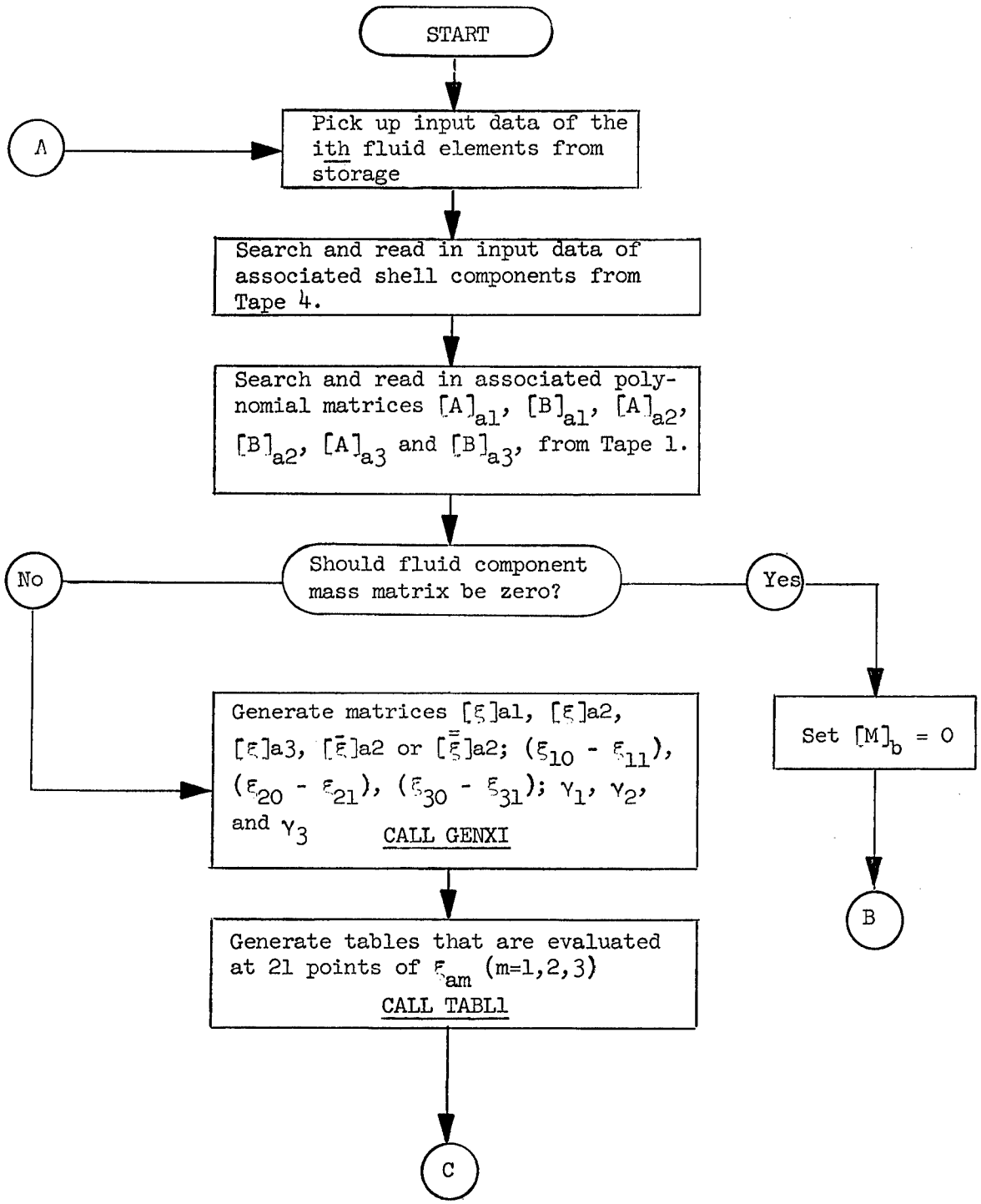
SCNTL CONSTRUCT STIFFNESS MATRIX AND MASS MATRIX FOR SHELL COMPONENTS

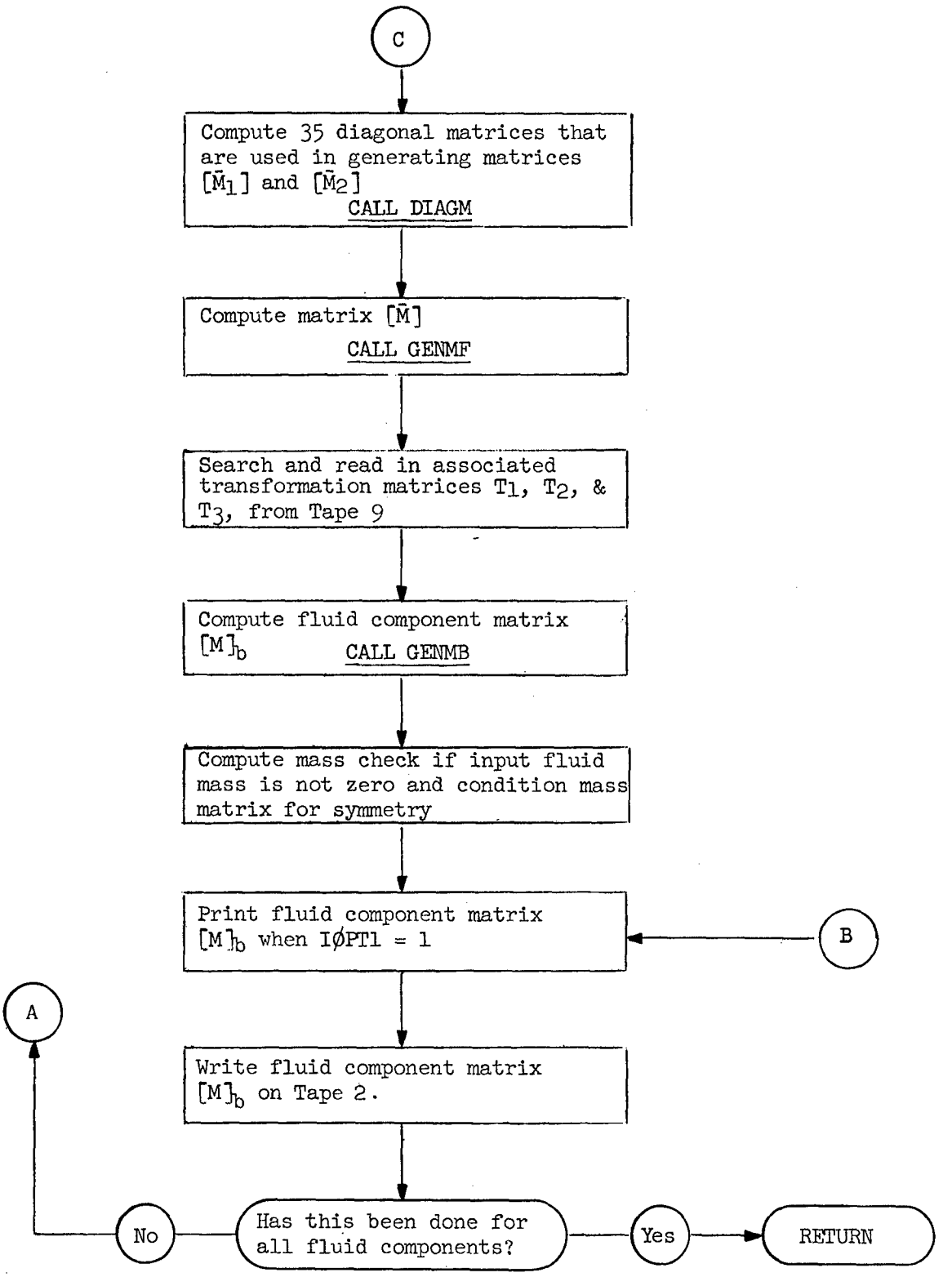


GENERATE STIFFNESS MATRIX AND MASS MATRIX FOR A SHELL COMPONENT

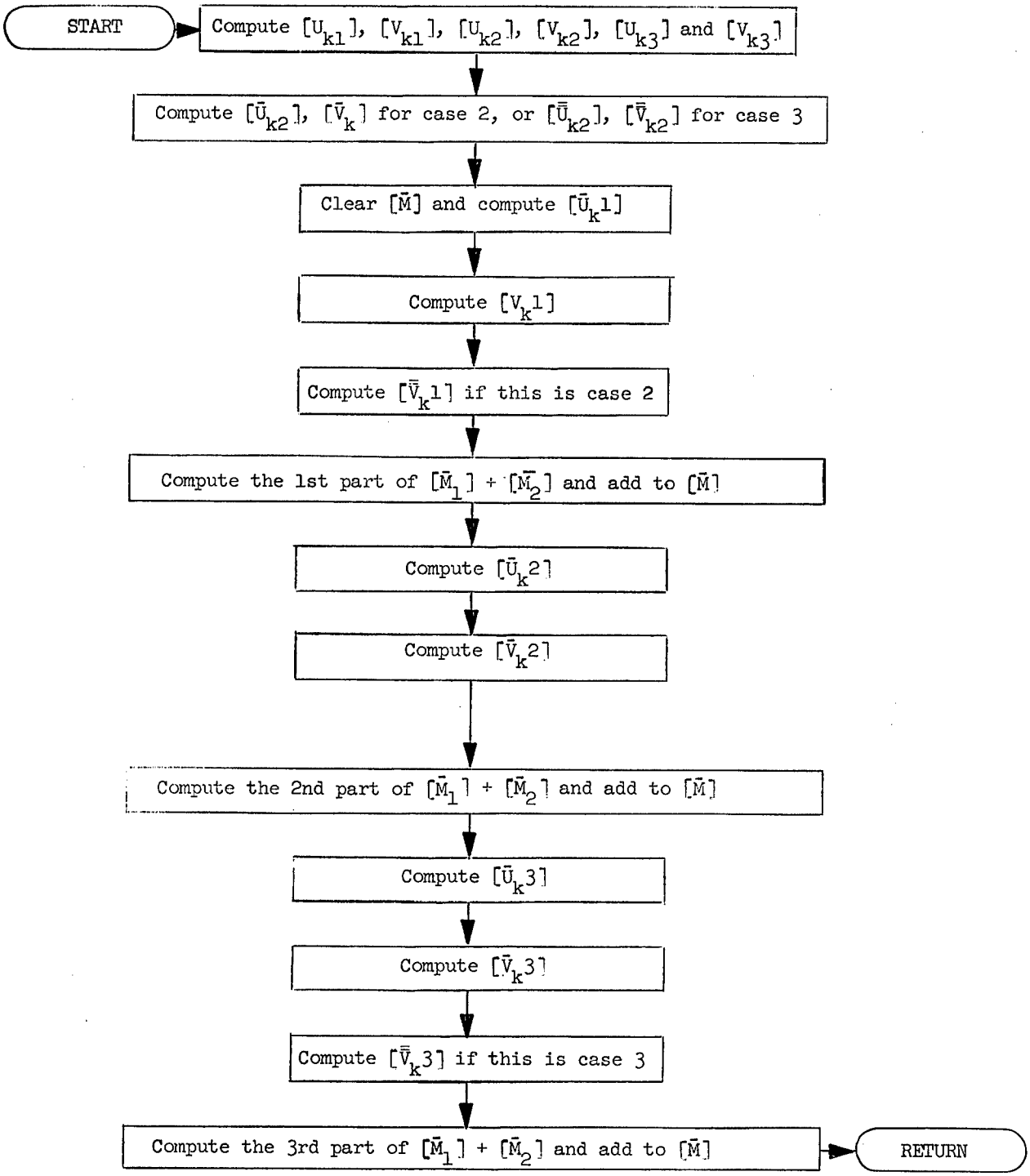


CONSTRUCT MASS MATRIX $[M]_b$ FOR FLUID COMPONENTS

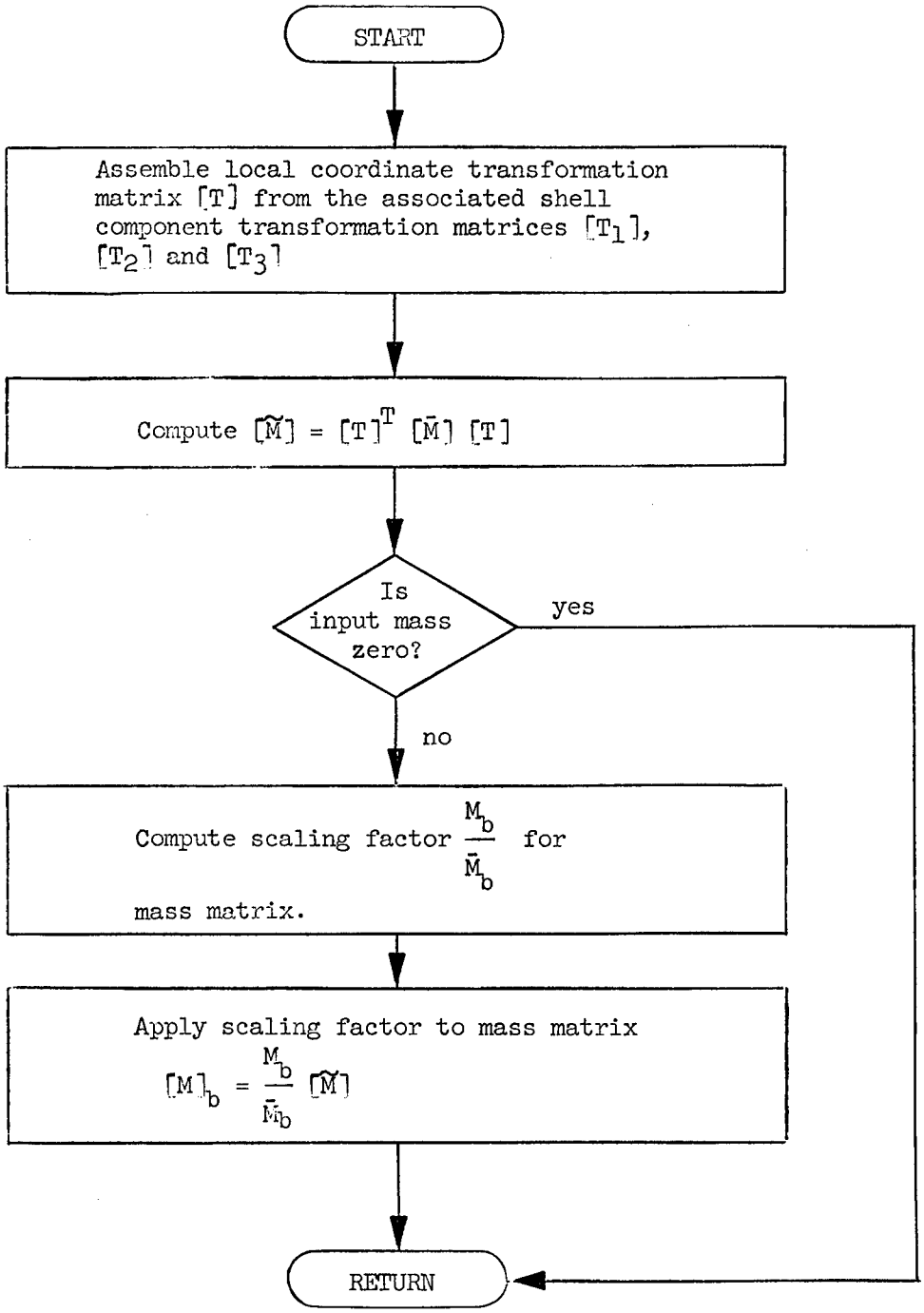



C
Compute 35 diagonal matrices that are used in generating matrices [M̃1] and [M̃2]
CALL DIAGM
Compute matrix [M̃]
CALL GENMF
Search and read in associated transformation matrices T1, T2, & T3, from Tape 9
Compute fluid component matrix [M]b
CALL GENMB
Compute mass check if input fluid mass is not zero and condition mass matrix for symmetry
Print fluid component matrix [M]b when IØPT1 = 1
B
A
Write fluid component matrix [M]b on Tape 2.
No
Has this been done for all fluid components?
Yes
RETURN

GENFM COMPUTE MATRIX $[\bar{M}]$ FOR A FLUID COMPONENT

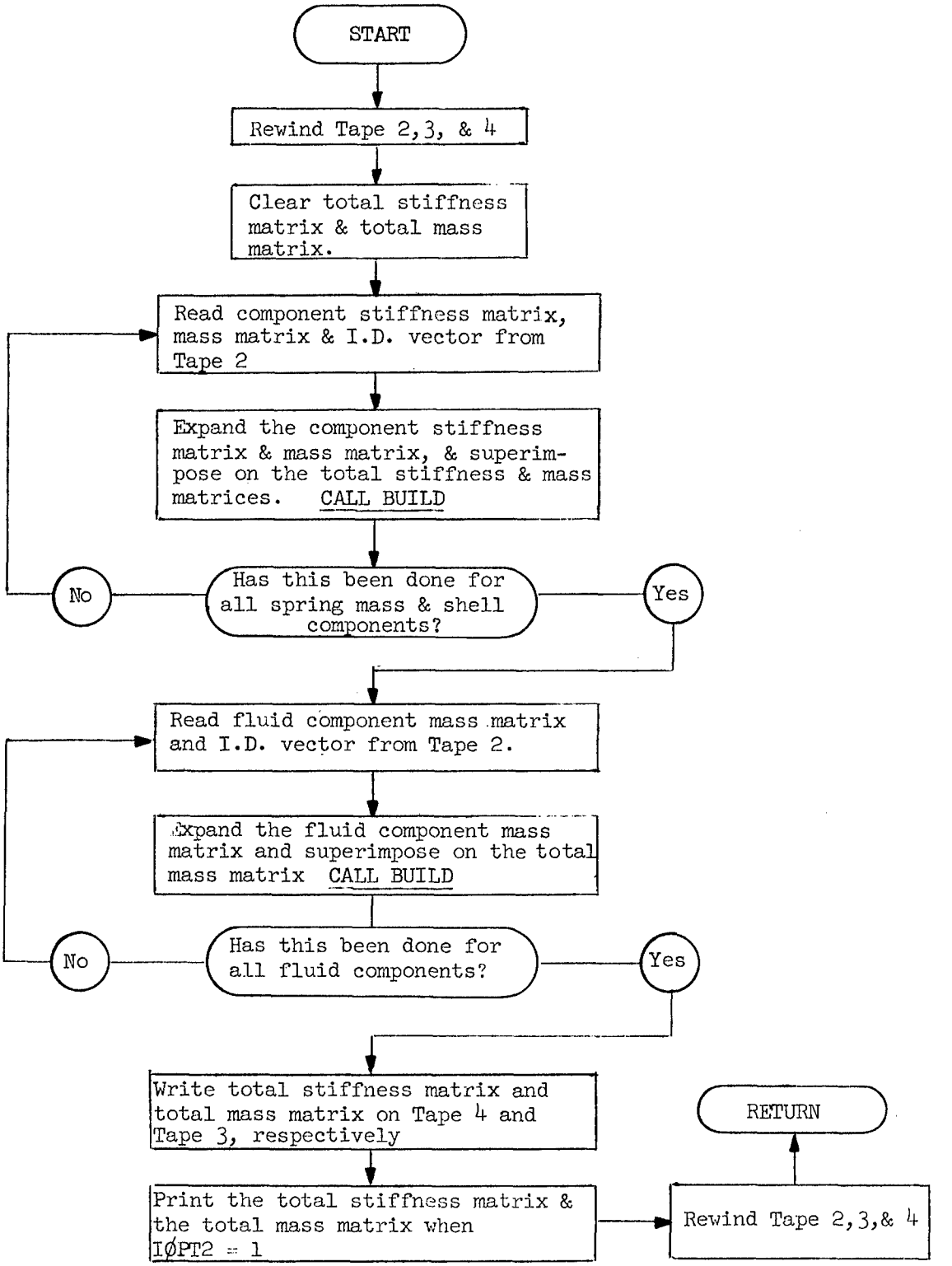


COMPUTE MASS MATRIX FOR A FLUID COMPONENT



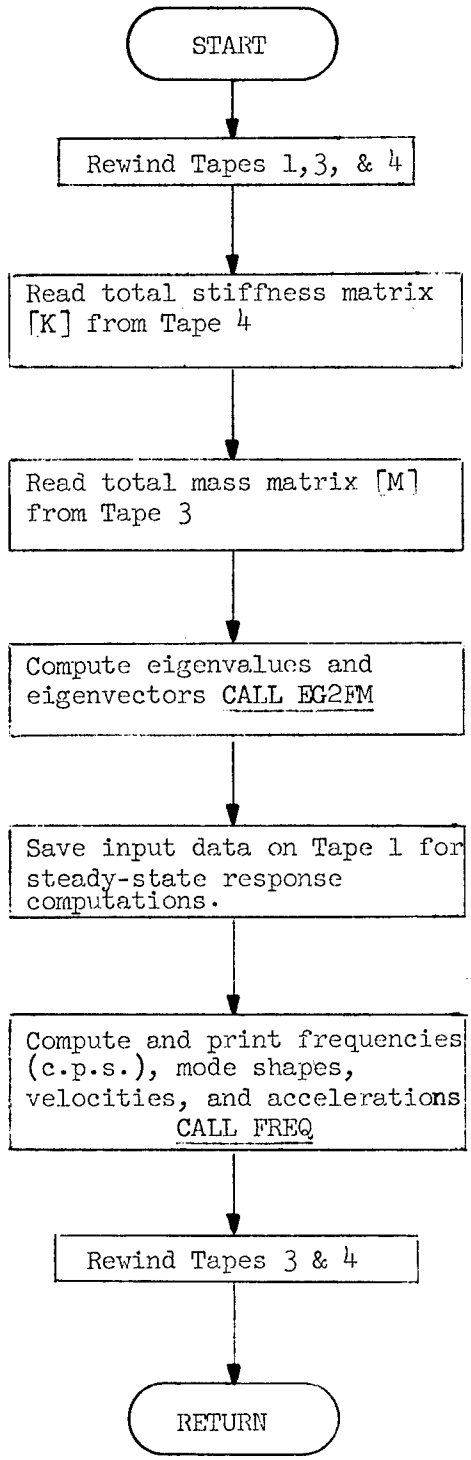
TØTKM

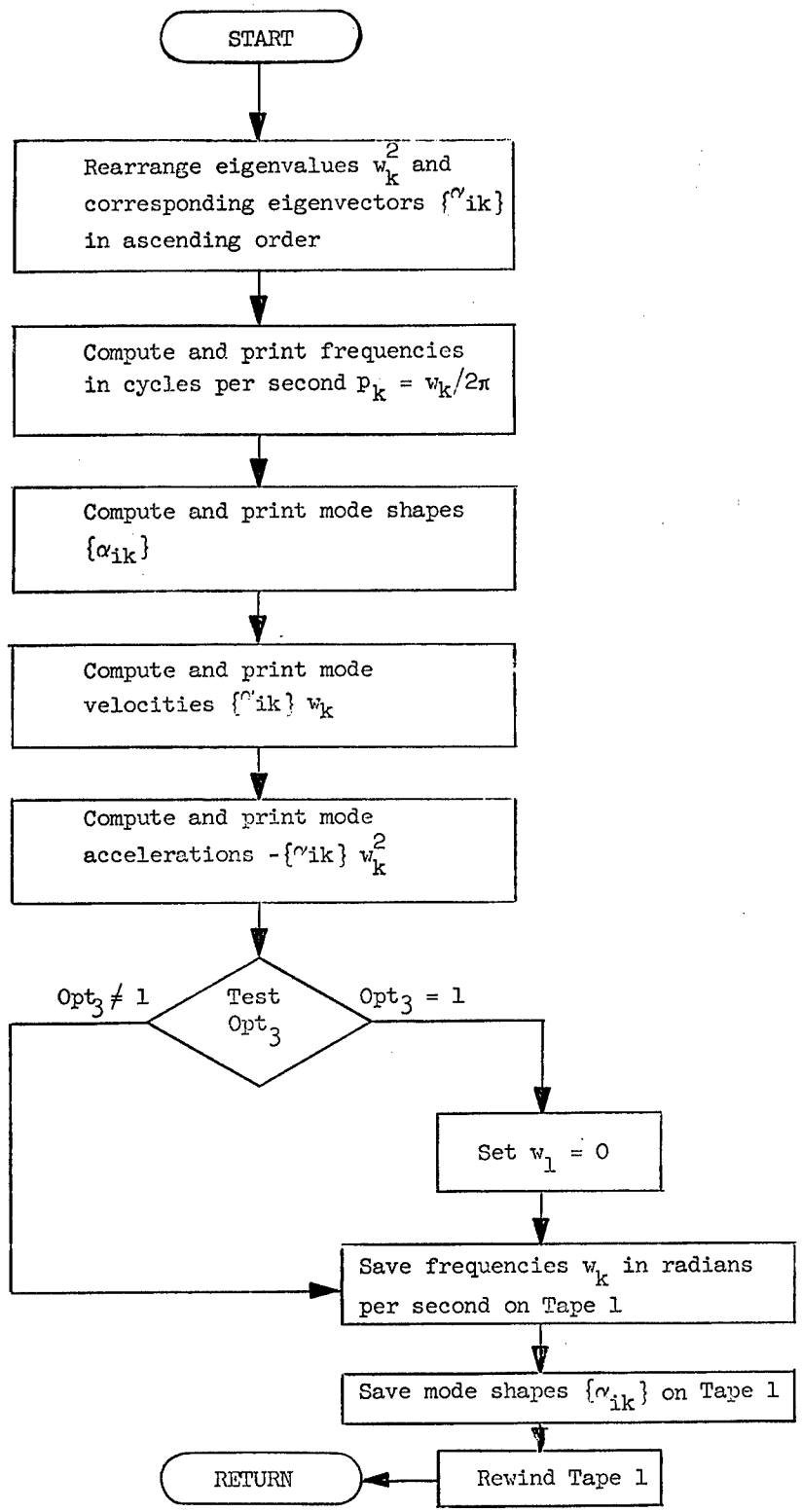
CONSTRUCT TOTAL STIFFNESS MATRIX AND TOTAL MASS MATRIX FROM COMPONENT MATRICES



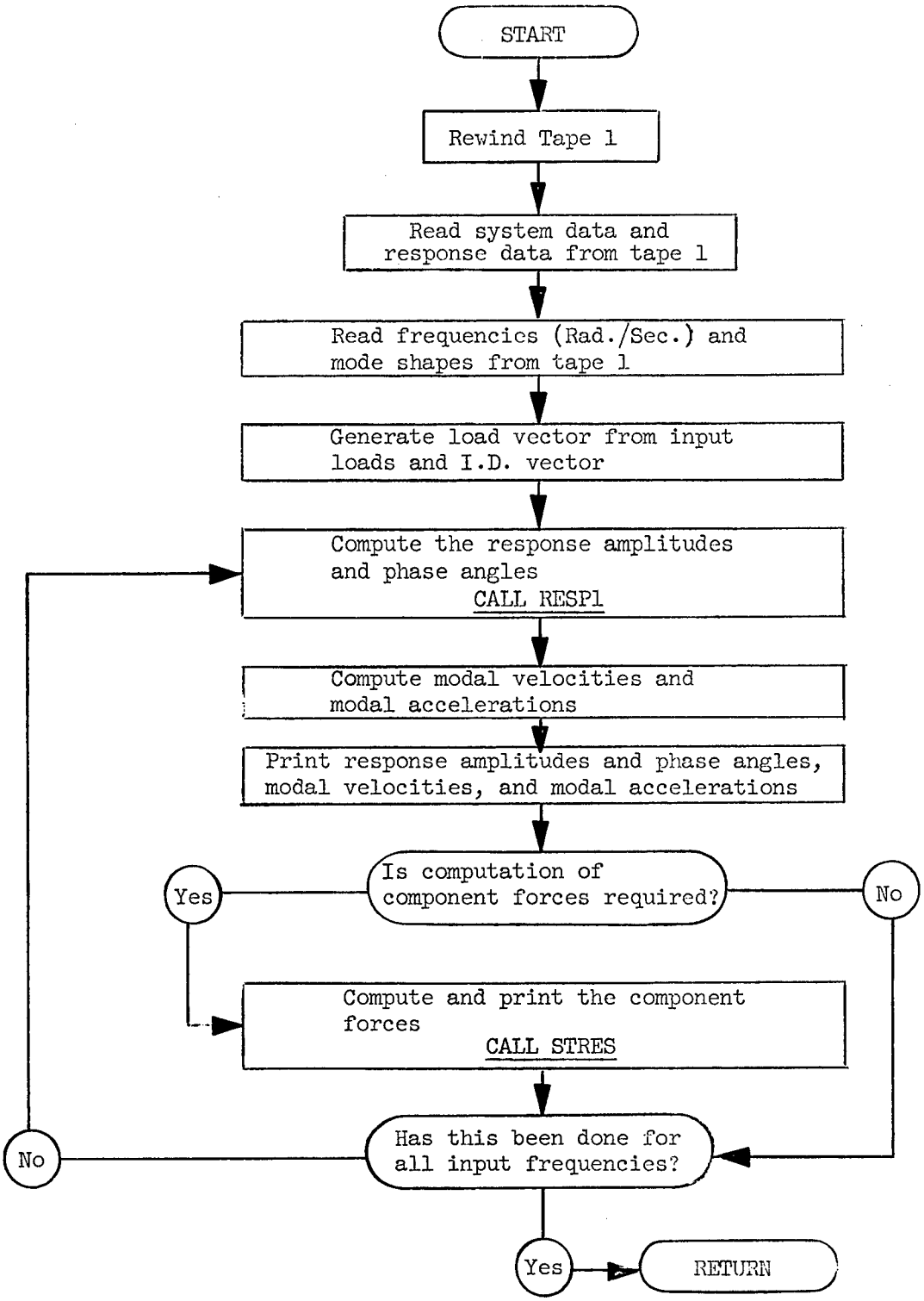
EGCNT

CONTROL PROGRAM TO COMPUTE AND PRINT FREQUENCIES, MODE SHAPES, VELOCITIES, AND ACCELERATIONS

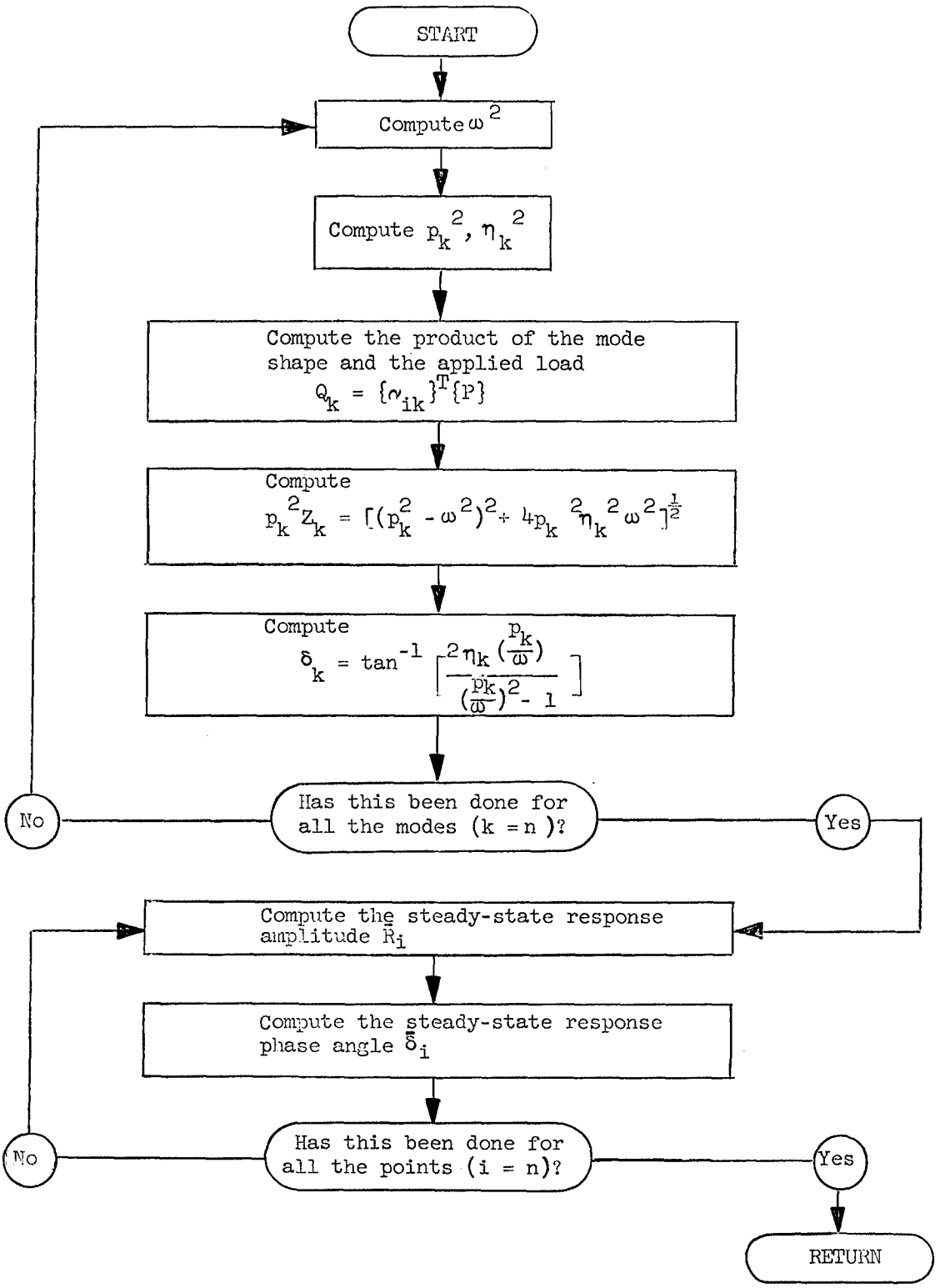



START
Rearrange eigenvalues w_k^2 and corresponding eigenvectors $\{\phi_{ik}\}$ in ascending order
Compute and print frequencies in cycles per second $p_k = w_k/2\pi$
Compute and print mode shapes $\{\alpha_{ik}\}$
Compute and print mode velocities $\{\dot{\phi}_{ik}\}$ w_k
Compute and print mode accelerations $-\{\phi_{ik}\}$ w_k^2
Test Opt_3
$Opt_3 \neq 1$
$Opt_3 = 1$
Set $w_1 = 0$
Save frequencies w_k in radians per second on Tape 1
Save mode shapes $\{\phi_{ik}\}$ on Tape 1
Rewind Tape 1
RETURN

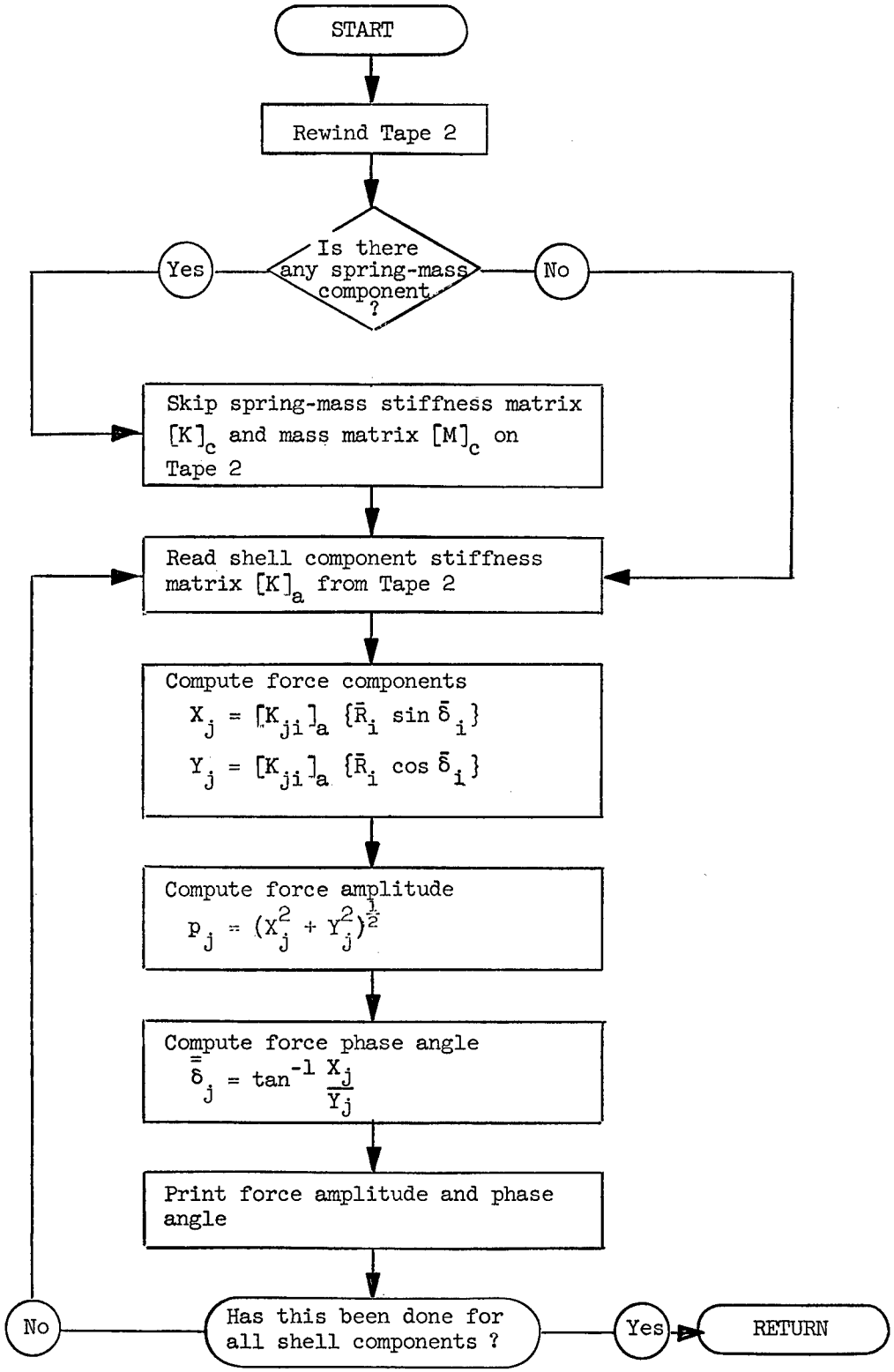
COMPUTE AND PRINT STEADY-STATE RESPONSE, VELOCITIES ACCELERATIONS, AND COMPONENT FORCES



RESP1 COMPUTE THE RESPONSE AMPLITUDE AND PHASE ANGLE



COMPUTE AND PRINT COMPONENT FORCES



III. OPERATING INSTRUCTIONS

A. HARDWARE REQUIREMENTS

1. IBM 7090 or 7094 computer with 32K core.
2. Data channels and tape units for the software.
3. No on-line printer and punch.
4. Peripheral equipment for card-to-tape, tape-to-printer, and tape-to-punch as required by standard IBM system.
5. It is assumed that standard keypunch and verifier machines, card readers, and printers are used; therefore, these have not been specified.

B. SOFTWARE REQUIREMENTS

1. IBSYS Operating System Tape Version 9

   a. Basic Monitor (IBSYS) Version 4
   b. Processor (IBJØB) Version 3
   c. Assembly Language (MAP) Version 3
   d. Assembly Language (FTC) Version 3
   e. Loader (IBLDR) Version 3

2. The Fortran IV I/O Library Subroutines

C. TAPE USAGE

The standard Fortran input/output configuration, as described in IBM 7090/7094 IBSYS Operating System: IBJOB Processor, Form C28-6275, is used for the logical tape unit designation and the file specifications are as follows:

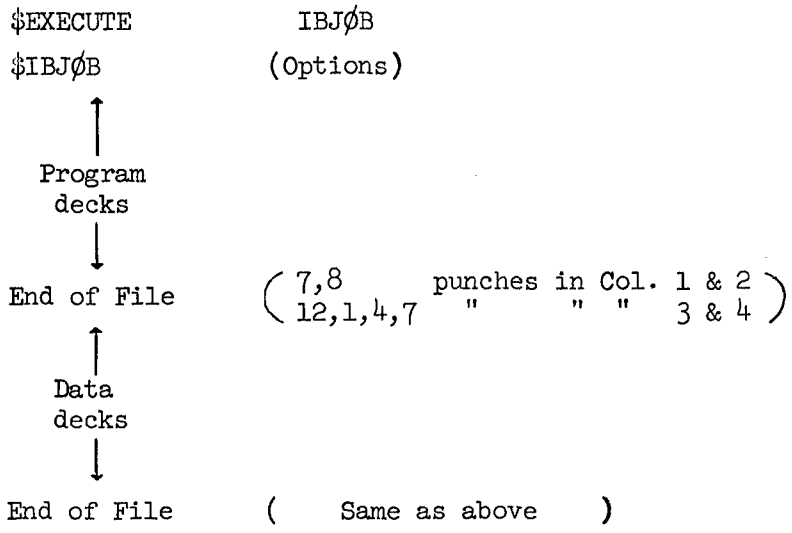
```
UNIT01 FILE ,A(1), HOLD,    INOUT, BLK = 256, BIN
UNIT02 FILE ,B(1), HOLD,    INOUT, BLK = 256, BIN
UNIT03 FILE ,UT3,  READY,   INOUT, BLK = 256, BIN, NOLIST
UNIT04 FILE ,UT4,  READY,   INOUT, BLK = 256, BIN, NOLIST
UNIT05 FILE ,IN,   READY,   INPUT, BLK =  14, MULTIREEL, BCD, NOLIST
UNIT06 FILE ,OU,   READY, OUTPUT, BLK = 110, MULTIREEL, BCD, NOLIST
UNIT07 FILE ,PP,   READY, OUTPUT, BLK =  28, MULTIREEL, BIN, NOLIST
UNIT09 FILE ,,     READY,   INOUT, BLK = 256, BIN, NOLIST
```

The logical tape unit 5 and 6 are used as input and output, respectively. The logical tape unit 1, 2, 3, 4, and 9 are used by this program as intermediate storage tapes and tape SYSLB2 is assigned to overlay.

D. DECK SET-UP

1. Installation control cards (e.g. $DATE card).

2.



For a description of these control cards see:

(IBM 7090/7094 Operation Systems Basic Monitor (IBSYS), Form C28-6248)

(IBM 7090/7094 IBSYS Operating System IBJØB Processor, Form C28-6275)

3. Installation control cards (e.g. $ENDFILE)

E. TIMING

The computer time for each case depends upon the number of individual components, the total number of system coordinates selected for the vehicle, and the number of forcing frequencies for the response. A typical case of twenty-one shells, four fluids, eight spring-mass components, and seventy-eight system coordinates took approximately six minutes to compute the natural frequencies ($S < 0$). For the same case, it took approximately six minutes to compute the response ($S = 2$, $opt_4 = 1$) for fifty forcing frequencies.

F. MULTIPLE CASES

The cases may be stacked for one computer run if any one of the following conditions are met:

1. All the cases have the same steady-state response option.

2. Each case has the steady-state response option of either $S < 0$ or $S = 0$. The necessary data for the steady-state computation is saved on tape 1 and tape 2 for the last case only.

3. Each case has the steady-state response option of either $S = 1$ or $S = 2$. All cases must be using the same set of data on tape 1 and tape 2 for the steady-state computation.

IV. INPUT DESCRIPTION

The input data is read in with symbolic data input subroutine FINP. See the FINP subroutine write-up for further details.

The following is a general description of the input data. The data consists of four logical blocks and must be set up in the same order that is given on the program input sheet. The symbols used in this description are the same as those stated in the left-hand column of the program input sheet.

A. THE SYSTEM INPUT DATA

1. Heading

HHEAD — is one line of BCD characters which will be printed as the title of the printed output. The number of BCD words (6 characters per word) must not exceed 11.

2. Input Parameters

N_C — is the total number of system coordinates which include the fixed coordinates N_O. $N_C - N_O$ must not exceed 80.

N_S — is the total number of shell components. N_S cannot be zero and must not exceed 40.

N_F — is the total number of fluid components. N_F must not exceed 6.

N_M — is the total number of spring-mass components. N_M must not exceed 30.

N_O — is the total number of fixed coordinates. $N_C - N_O$ must not exceed 80.

3. Applied Loads and Forcing Frequencies

N_L — is the total number of discrete applied loads. N_L must not exceed 80.

C_i — is the applied load coordinates $C_1, C_2, C_3, \ldots, C_{N_L}$.

P_i is the discrete applied loads $P_1, P_2, P_3, \ldots, P_{N_L}$.

N_W is the number of sets of forcing function frequencies.

$f_i, \Delta f_i, m_i$ f is the frequency of the forcing function in cycles per second. This program will compute the steady-state response for the frequencies $f_i, f_i + \Delta f_i, f_i + 2\Delta f_i, \ldots, f_i + (m_i - 1)\Delta f_i$, $i = 1, 2, \ldots, N_W$.

4. Modal Damping Factors

N_{ET} is the number of input η. Program will generate a complete table of η by setting $\eta_{(N_{ET}+1)}, \eta_{(N_{ET}+2)}, \ldots, \eta_{(N_C-N_O)}$ equal to $\eta_{N_{ET}}$.

η_k is the ratio of the assumed damping to the critical damping in mode k $\eta_1, \eta_2, \eta_3, \ldots \eta_{N_{ET}}$.

5. Ratio of Accelerations

g is the ratio of the vehicle acceleration to the acceleration of gravity.

6. Steady-State Response Option

S is a fixed point word which controls the option of computing steady-state response.

S<0 indicates that the computation of the steady-state response is not included. The necessary data for the steady-state computation is saved on Tape 1 and 2.

S=0 indicates that the computation of the steady-state response is included.

S>0 is the option to compute the steady-state response only. The necessary data should be available on Tape 1 and 2.

S=1, Heading (Item A.1.), Input Parameters (Item A.2.), and Modal Damping Factors (Item A.4.) are supplied as input.

S=2, Heading (Item A.1.), Input Parameters (Item A.2.), Applied Loads and Forcing Frequencies (Item A.3.), Modal Damping Factors (Item A.4.), and the option word opt_4 are supplied as input.

7. Print Options

opt_1 is a option word which controls the output of stiffness matrix and mass matrix of the shell and the fluid components.

opt_1 = 1, print the component matrices

opt_1 = 0, suppress the printing of component matrices.

opt_2 is a option word which controls the printing of total stiffness matrix and total mass matrix.

opt_2 = 1, print the total stiffness and mass matrices.

opt_2 = 0, suppress the printing of total stiffness and mass matrices.

opt_3 is a option word which sets the rigid body frequency to zero for computing the response.

opt_3 = 1, set the first frequency to zero.

opt_3 = 0, do not set the first frequency to zero.

opt_4 is a option word which controls the computation and printing of forces for the steady-state response.

opt_4 = 1, compute and print the forces.

opt_4 = 0, do not compute and print the forces.

N_{EI} is the number of frequencies, mode shapes, velocities and accelerations that will be printed as the final output.

8. Polynomial Matrices

N_P is the total number of polynomial matrices.

$\bar{U}_k$ is the number of rows of polynomial matrix $[A]_{\bar{U}_k}$ x 11.

$\bar{V}_k$ is the number of rows of polynomial matrix $[B]_{\bar{V}_k}$ x 11.

$[A]_k$ is $\bar{U}_k$ x 11 polynomial matrix.

$[B]_k$ is $\bar{V}_k$ x 11 polynomial matrix.

$k = 1, 2, 3, \ldots, N_P$

The input sequence of the polynomial matrices establishes the identification number k which is referred by the shell components. The subscript k is used as the polynomial matrix identification number by the shell components.

B. THE SHELL COMPONENT INPUT DATA

1. I.D. Number

a is the identification number for shell component a where $0 < a \leq N_S$

+ a indicates a conical shell component

- a indicates an ellipsoidal shell component

2. Coordinates

U, V	are the total number of system coordinates.
$\bar{U}$, $\bar{V}$	are the total number of local coordinates $\bar{U}$, $\bar{V}$ must not exceed 11.

3. Coordinate I.D. Vector

$(ID)_i$	is the identification vector which is used to position the elements for building total stiffness and mass matrices. The length of the vector must be equal to $\bar{U} + \bar{V}$ and the number must not be greater than N_C.

4. Polynomial Matrix Identification Number

k	is the polynomial matrix identification number which refers to polynomial matrices $[A]_k$ and $[B]_k$ in the system input data.

5. Shell Geometric Data

ϕ_o	is the meridional angle for conical shell and is the edge meridional angle for ellipsoidal shell. ϕ_o is input in degrees.
L	is the height of conical shell + L indicates converging upward - L indicates converging downward L = 0 for ellipsoidal shell input
R_2	is the lower radius of conical shell R_2 = 0 for ellipsoidal shell input
$\bar{b}$	is the height of ellipsoidal shell + $\bar{b}$ indicates convex upward - $\bar{b}$ indicates convex downward $\bar{b}$ = 0 for conical shell input
$\bar{a}$	is the radius of the base of ellipsoidal shell. $\bar{a}$ = 0 for conical shell input.

6. Orthotropic Shell Constants and Thickness

$(C_{11})_p$ $(C_{12})_p$ $(C_{22})_p$	are orthotropic shell constants at two points $p = 1,2$.
$(C_{33})_p$ $(C_{34})_p$ $(C_{44})_p$	are orthotropic shell constants at four points $p = 1,2,3,4$.
$(t)_p$	are shell thickness at two points $p = 1,2$.

7. Mass Density and Total Mass

γ_a	is the mass density of the shell component.
M_a	is the total mass of the shell component.
	$M_a \neq 0$, the ratio of the total mass M_a to the computed mass $\bar{M}_a$ will be used as the scaling factor for the mass matrix. When $opt_1 = 1$, the scaling factor will be printed as the mass check of the mass matrix.
	$M_a = 0$, no scaling factor will be used for the mass matrix. When $opt_1 = 1$, the computed mass will be printed.

8. Initial Stress Data

H_i	is the depth of interior fluid.
w_i	is the weight density of interior fluid
P_i	is the uniform interior pressure.
H_e	is the depth of exterior fluid.
w_e	is the weight density of exterior fluid.

P_e	is the uniform exterior pressure
W	is the reactive force at upper edge of conical shell.
	+ W produces tensile stresses.
	- W produces compressive stresses
	W = 0 for ellipsoidal shells.

C. THE FLUID COMPONENT INPUT DATA

1. I.D. Number

b	is the identification number for fluid component b where $0 < b \leq N_F$.

2. Associated Shell Components

a_1, a_2, and a_3	are the identification numbers of the associated shell components

3. Fluid Data

H	is the depth of fluid component.
γ	is the mass density of fluid component.
M	is the mass of fluid component.
	$M \neq 0$, the ratio of the total mass M to the computed mass $\bar{M}$ will be used as the scaling factor for the mass matrix. When $opt_1 = 1$, the scaling factor will be printed as the mass check of the mass matrix.
	M = 0, no scaling factor will be used for the mass matrix. When $opt_1 = 1$, the computed mass will be printed.

D. THE SPRING-MASS COMPONENT INPUT DATA

1. I.D. Number

c	is the identification number of spring-mass component c where $0 < c \leq N_M$.

2. Stiffness and Mass Matrices

n	is the order of the spring-mass component n must not exceed 10.
$[K]_c$	is n x n stiffness matrix of spring-mass component.
$[M]_c$	is n x n mass matrix of spring-mass component.

3. Coordinate I.D. Vector

IDC_i	is the identification vector which is used to position the elements for building the total stiffness and mass matrices. The length of the vector must be equal to n and the number must not be greater than N_C.

Note: Care must be taken so that the units of the input data are consistent.

THE SYSTEM INPUT DATA

SPACE TECHNOLOGY LABORATORIES, INC.
COMPUTATION AND DATA REDUCTION CENTER

DATE _____ PAGE ____ OF ____

NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

1	7	73
HHEAD	1	

X3

SYMBOL	1 19 37 55 PRE	2 20 38 56 LOC.	7 25 43 61 VALUE	17 35 53 71 EXP.	73
N_C	I	NC			
N_S	I	NS			
N_F	I	NF			
N_M	I	NM			
N_O	I	NØ			
N_L	I	NL			
C_1	I	LDCRD			
C_2	I				
.	.				
.	.				
.	.				
.	.				
C_{N_L}	I				
P_1		ALØAD			
P_2					
.					
.					
.					
P_{N_L}					
N_W	I	NW			
f_1		ØMEGA			
Δf_1					
m_1	I				
.					
.					
f_{N_W}					
Δf_{N_W}					
m_{N_W}	I				
N_{ET}	I	IETAK			
η_1		ETAK			
η_2					
.					

X3

Note: At TRW Ø indicates the alphabetic O and not zero.

STL FORM 1601

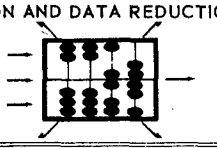
SPACE TECHNOLOGY LABORATORIES, INC.
COMPUTATION AND DATA REDUCTION CENTER

DATE _____ PAGE _____ OF _____

NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____



1	7	73

X3

SYMBOL	PRE	LOC.	VALUE	EXP.
•				
•				
γN_{ET}				
g		G		
S	I	INS		
opt_1	I	IØPT1		
opt_2	I	IØPT2		
opt_3	I	IØPT3		
opt_4	I	IØPT4		
N_{EI}	I	NEI		
N_P	I	NP		
	E	ND		
$\bar{U}_k$	I	UBAR		
$\bar{V}_k$	I	VBAR		
$[A]_k$	M	APØLY	11,11	
		OI,OJ		
$[B]_k$	M	BPØLY	11,11	
		OI,OJ		

X3

STL FORM 1601

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DATE _____ PAGE _____ OF _____

NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

1	7	73

X3

SYMBOL	1 19 37 55 PRE	2 20 38 56 LOC.	7 25 43 61 VALUE	17 35 53 71 EXP.	73
	E	ND			
k=1,2,3 ....N_p					

THE SHELL COMPONENT INPUT DATA

SPACE TECHNOLOGY LABORATORIES, INC.
COMPUTATION AND DATA REDUCTION CENTER

DATE _____ PAGE _____ OF _____

NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

1	7	73

X3

SYMBOL	P_{R_E}	LOC.	VALUE	EXP.
a	I	INA		
U	I	IU		
V	I	IV		
$\bar{U}$	I	IUB		
$\bar{V}$	I	IVB		
$(ID)_1$	I	IDVT		
$(ID)_2$	I			
.	.			
.	.			
.	.			
$(ID)_{\bar{U}+\bar{V}}$	I			
k	I	INK		
ϕ_o		PHIN		
L		XL		
R_2		R2IN		
$\bar{b}$		BBAR		
$\bar{a}$		ABAR		
$(C_{11})_1$		C11I		
$(C_{11})_2$				
$(C_{12})_1$		C12I		
$(C_{12})_2$				
$(C_{22})_1$		C22I		
$(C_{22})_2$				
$(C_{33})_1$		C33I		
$(C_{33})_2$				
$(C_{33})_3$				
$(C_{33})_4$				
$(C_{34})_1$		C34I		
$(C_{34})_2$				
$(C_{34})_3$				
$(C_{34})_4$				
$(C_{44})_1$		C44I		
$(C_{44})_2$				

X3

STL FORM 1601

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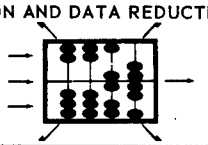

1	7	73

X3

	1 19 37 55	2 20 38 56	7 25 43 61	17 35 53 71	73
SYMBOL	PRE	LOC.	VALUE	EXP.	
$(C_{44})_3$					
$(C_{44})_4$					
$(t)_1$		THI			
$(t)_2$					
γ_a		DESTA			
M_a		AM			
H_i		HI			
w_i		DESTI			
P_i		PRI			
H_e		HE			
w_e		DESTE			
P_e		PRE			
W		WFØRC			
	E	ND			

X3

STL FORM 1601

THE FLUID COMPONENT INPUT DATA

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SYMBOL	PRE	LOC.	VALUE	EXP.
b	I	INB		
a_1	I	IDA1		
a_2	I	IDA2		
a_3	I	IDA3		
H		HF		
γ		DESTF		
M		FM		
	E	ND		

1 2 7 17 73
19 20 38 25 35
37 38 56 43 53
55 56 61 71

X3

STL FORM 1601

THE SPRING-MASS COMPONENT INPUT DATA

SPACE TECHNOLOGY LABORATORIES, INC.
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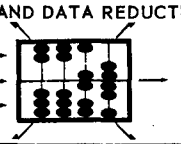

1	7	73

X3

SYMBOL	PRE (1, 19, 37, 55)	LOC. (2, 20, 38, 56)	VALUE (7, 25, 43, 61)	EXP. (17, 35, 53, 71)	73
c	I	INC			
n	I	IN			
$[K]_e$	M	CK	10, 10		
		OI, OJ			
$[M]_e$	M	CM	10, 10		
		OI, OJ			
$(IDC)_1$	I	IDVIC			
$(IDC)_2$	I				
.	.				
.	.				
.	.				
$(IDC)_n$	I				
	E	ND			

X3

STL FORM 1601

V. OUTPUT DESCRIPTION

The output of this program consists of four parts. The following is a general description:

A. INDIVIDUAL MATRICES

When $opt_1 = 1$, the following component matrices will be printed:

1. Stiffness matrix of shell component with equilibrium check.
2. Mass matrix of shell component with mass check.
3. Mass matrix of fluid component with mass check.

B. TOTAL MATRICES

When $opt_2 = 1$, the following total matrices will be printed:

1. Total stiffness matrix.
2. Total mass matrix.

C. MODAL SUMMARY DATA

The following modal summary data are printed. The number of modes printed depends on the input parameter N_{EI}.

1. Natural frequencies in cycles per second.
2. Mode shapes by columns.
3. Mode velocities by columns.
4. Mode accelerations by columns.

D. RESPONSE SUMMARY DATA

The following data are printed for the modal response expression $\{R_i\} = \{\bar{R}_i\} \sin (\omega t - \{\bar{\delta}_i\})$

1. Amplitudes $\{\bar{R}_i\}$
2. Phase angles $\{\bar{\delta}_i\}$
3. Modal velocities $\{R_i\}\omega$
4. Modal accelerations - $\{R_i\}\omega^2$

When $opt_4 = 1$, the following data are printed for the component force expression: $\{S_i\} = \{\bar{S}_i\} \sin (\omega t - \{\bar{\bar{\delta}}_i\})$

5. Amplitudes $\{\bar{S}_i\}$
6. Phase angles $\{\bar{\bar{\delta}}_i\}$

VI. TEST CASE

A one-stage launch vehicle is used as a test case to illustrate the input data requirements and to present the results in the final output format.

In this example the vehicle is represented by eleven shell components, two fluid components and four spring-mass components.

The input sheets and the computer output sheets are included in this section.

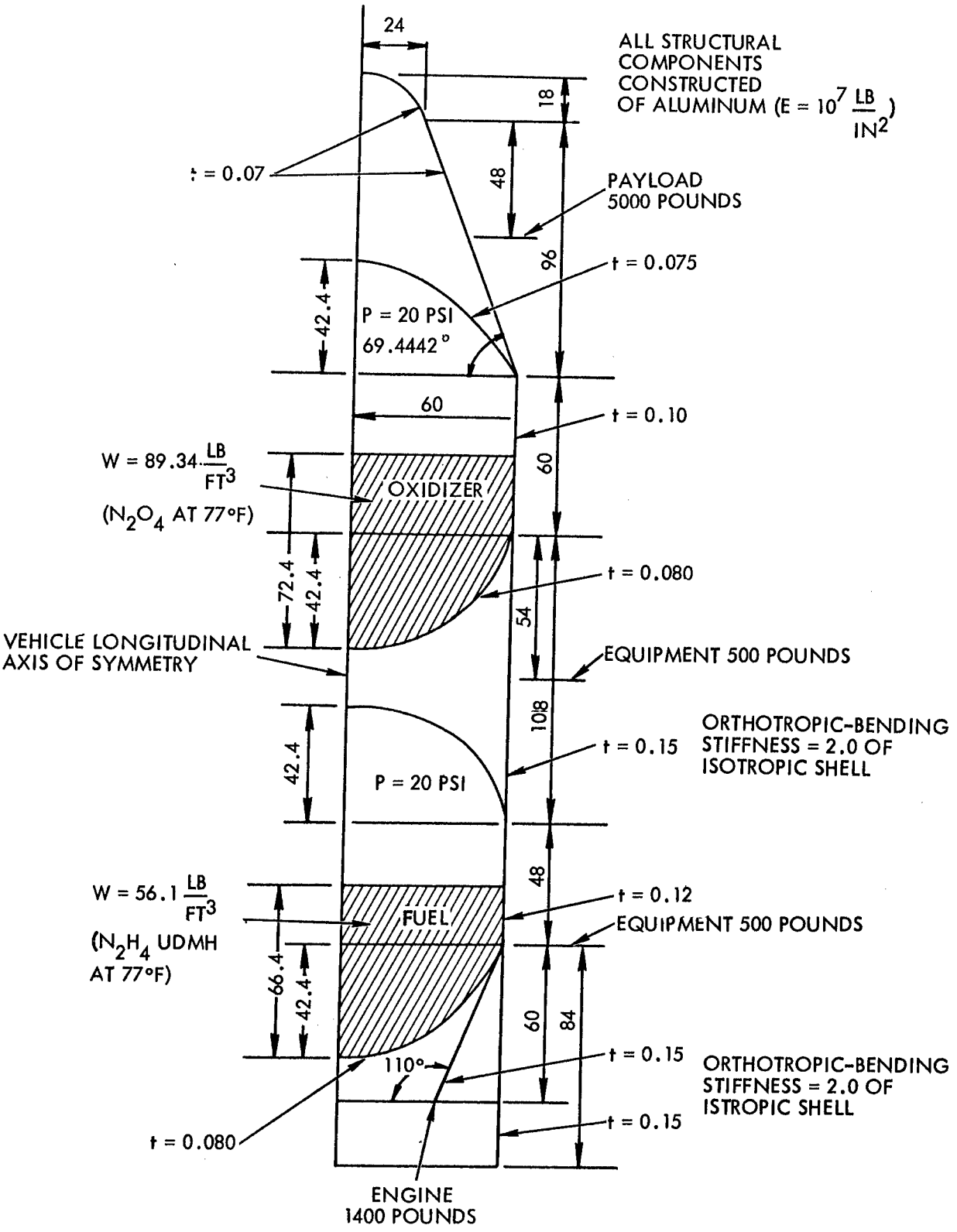

Figure 1. Launch Vehicle

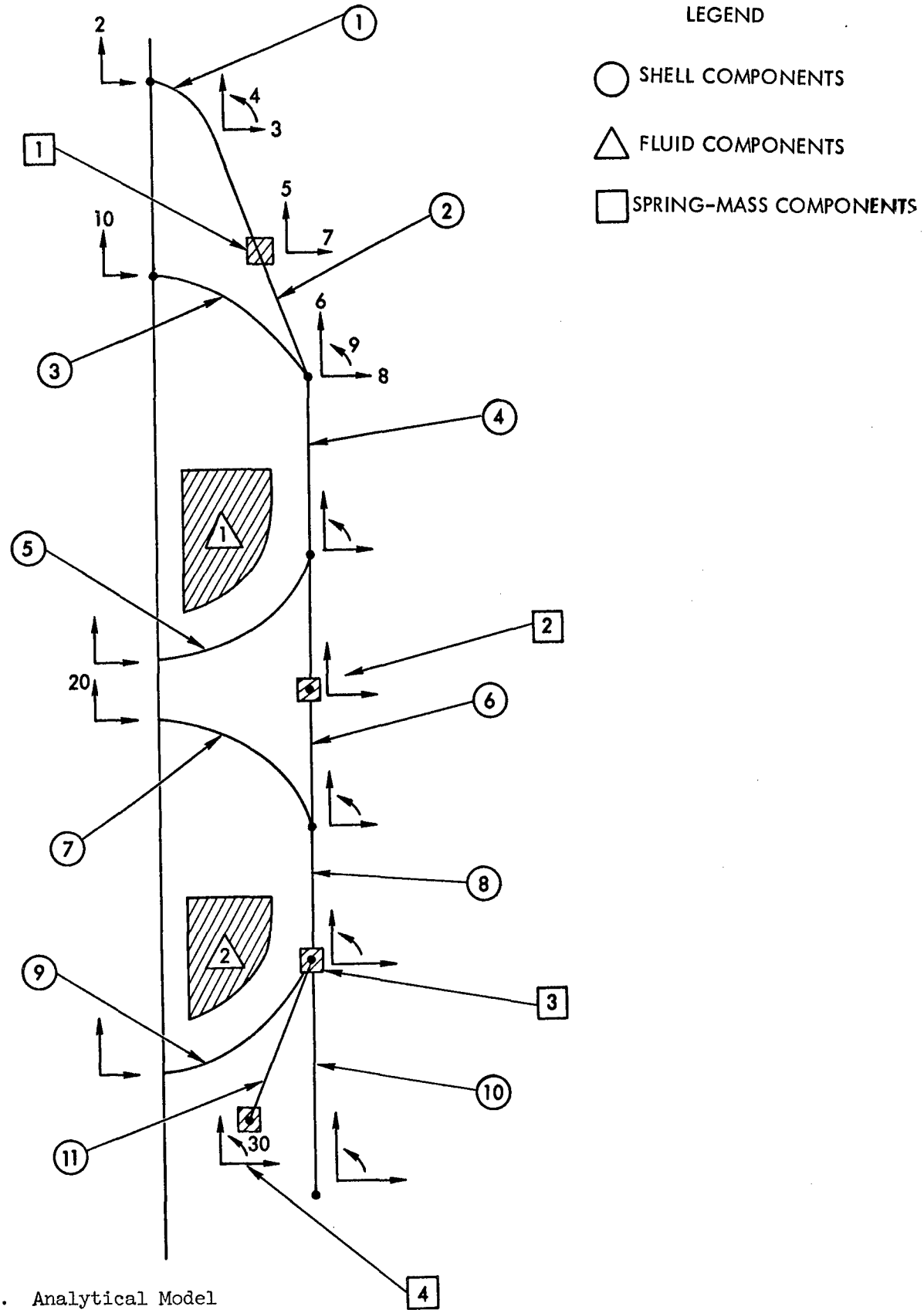

Figure 2. Analytical Model

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SYMBOL	P/R/E	LOC.	VALUE	EXP.
	I	NC	30	
	I	NS	11	
	I	NF	2	
	I	NA1	4	
	I	NΦ	0	
		G	1.0	
	I	INS	-1	
	I	IAPT1	1	
	I	IAPT2	1	
	I	IAPT3	0	
	I	IAPT4	0	
	I	NET	30	
	I	INP	3	
	E	ND		
1	I	UBAR	2	
	I	VBAR	2	
	M	APALY	11,11	
		01,01	1.0	
		02,03	1.0	
	M	BPALY	11,11	
		01,02	1.0	
		02,03	1.0	
	E	ND		
2	I	UBAR	2	
	I	VBAR	4	
	M	APALY	11,11	
		01,01	1.0	
		02,02	1.0	
	M	BPALY	11,11	
		01,01	1.0	
		02,02	1.0	
		03,03	1.0	

SYMBOL	P/R/E	LOC.	VALUE	EXP.
		04,04	1.0	
	E	ND		
3	I	UBAR	3	
	I	VBAR	5	
	M	APALY	11,11	
		01,01	1.0	
		02,02	1.0	
		03,03	1.0	
	M	BPALY	11,11	
		01,01	1.0	
		02,02	1.0	
		03,03	1.0	
		04,04	1.0	
		05,05	1.0	
	E	ND		

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1	7	73
		X1

SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	-1	
	I	IU	2	
	I	IV	2	
	I	IIVB	2	
	I	IVB	2	
	I	IDVT	1	
	I		2	
	I		3	
	I		4	
	I	INK	1	
		PHIN	69.444	
		XL	0.	
		R2IN	0.	
		BBAR	18.0	
		ABAR	24.0	
		C11I	.7692307	06
			.7692307	06
		C12I	.2307692	06
			.2307692	06
		C22I	.7692307	06
			.7692307	06
		C33I	.31410256	03
			.31410256	03
			.31410256	03
			.31410256	03
		C34I	.94230769	02
			.94230769	02
			.94230769	02
			.94230769	02
		C44I	.31410256	03
			.31410256	03
			.31410256	03
			.31410256	03
		THI	.07	
			.07	
		DESTA	.2588	-3
		AM	0.	
		HI	0.	
		DESTI	0.	
		PRI	0.	

SYMBOL	PRE	LOC.	VALUE	EXP
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WEAR	0.	
	E	ND		

X1

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	2	
	I	IU	3	
	I	IV	3	
	I	IUB	3	
	I	IVB	5	
	I	IDVT	1	
	I		5	
	I		6	
	I		3	
	I		7	
	I		8	
	I		4	
	I		9	
	I	INK	3	
		PHIN	69.444	
		XL	96.	
		R2IN	60.	
		BBAR	0.	
		ABAR	0.	
		C11I	.7692307	06
			.7692307	06
		C12I	.2307692	06
			.2307692	06
		C22I	.7692307	06
			.7692307	06
		C33I	.31410256	03
			.31410256	03
			.31410256	03
			.31410256	03
		C31I	.94230769	02
			.94230769	02
			.94230769	02
			.94230769	02
		C41I	.31410256	03
			.31410256	03
			.31410256	03
			.31410256	03
		THI	.07	
			.07	
		DESTA	.2555	-3

SYMBOL	PRE	LOC.	VALUE	EXP
		AM	.490146	
		HI	0.	
		DESTI	0.	
		PRI	0.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WEAR	-19.8	
	E	ND		

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	-3	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	2	
	I	IDVI	6	
	I		10	
	I		8	
	I		9	
	I	INK	1	
		PHIN	69.444	
		XL	0.	
		R2IN	0.	
		BBAR	42.4	
		ABAR	60.	
		C11I	.8241758	06
			.8241758	06
		C12I	.2412527	06
			.2412527	06
		C22I	.8241758	06
			.8241758	06
		C33I	.38633241	03
			.38633241	03
			.38633241	03
			.38633241	03
		C34I	.11589772	03
			.11589772	03
			.11589772	03
			.11589772	03
		C44I	.38633241	03
			.38633241	03
			.38633241	03
			.38633241	03
		THI	.075	
			.075	
		DESTA	.2588	-3
		AA	0.	
		HI	0.	
		DESTI	0.	
		PRI	20.	

SYMBOL	PRE	LOC.	VALUE	EXP
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WEDRK	0.	
	E	ND		

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	4	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	4	
	I	IDVT	6	
	I		11	
	I		8	
	I		12	
	I		9	
	I		13	
	I	INK	2	
		PHIN	90.	
		XL	60.	
		RZIN	60.	
		ABAR	0.	
		ABAR	0.	
		C11I	1.098901	06
			1.098901	06
		C12I	.3296703	06
			.3296703	06
		C22I	1.098901	06
			1.098901	06
		C33I	.9157150	03
			.9157150	03
			.9157150	03
			.9157150	03
		C34I	.2747250	03
			.2747250	03
			.2747250	03
			.2747250	03
		C44I	.9157150	03
			.9157150	03
			.9157150	03
			.9157150	03
		THI	.10	
			.10	
		DESTA	.2588	-3
		AM	.5853889	
		HI	30.	

SYMBOL	PRE	LOC.	VALUE	EXP
		DESTI	.51701388	-1
		PRI	20.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WFARC	-5347022	
		END		

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	-5	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	2	
	I	IDVT	11	
	I		14	
	I		12	
	I		13	
	I	INK	1	
		PHIN	90.	
		XL	0.	
		R2IN	0.	
		BBAR	-42.4	
		ABAR	60.	
		C11I	.87912	06
			.87912	06
		C12I	.263736	06
			.263736	06
		C22I	.87912	06
			.87912	06
		C33I	.46886447	03
			.46886447	03
			.46886447	03
			.46886447	03
		C34I	.14065934	03
			.14065934	03
			.14065934	03
			.14065934	03
		C44I	.46886447	03
			.46886447	03
			.46886447	03
			.46886447	03
		THI	.08	
			.08	
		DESTA	.2588	-3
		AM	.380503	
		HI	-30.	
		DESTI	.51701388	-1
		PRI	20.	

SYMBOL	PRE	LOC.	VALUE	EXP
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WEARC	0.	
	E	ND		

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1	7	73
		X1

SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	6	
	I	IU	3	
	I	IV	3	
	I	IUB	3	
	I	IVB	5	
	I	IOVT	11	
	I		15	
	I		16	
	I		12	
	I		17	
	I		18	
	I		13	
	I		19	
	I	INK	3	
		PHIN	90.	
		XL	108.	
		R2IN	60.	
		BBAR	0.	
		ABAR	0.	
		C11I	1.64835	06
			1.64835	06
		C12I	.494505	06
			.494505	06
		C22I	1.64835	06
			1.64835	06
		C33I	.618	04
			.618	04
			.618	04
			.618	04
		C34I	.185	04
			.185	04
			.185	04
			.185	04
		C44I	.618	04
			.618	04
			.618	04
			.618	04
		THI	.15	
			.15	
		DESTA	.2588	-3

SYMBOL	PRE	LOC.	VALUE	EXP
		AM	1.580557	
		HI	0.	
		DESTI	0.	
		PRI	0.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WEARC	-39479.357	
	E	ND		

X1

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	-7	
	I	IU	2	
	I	IV	2	
	I	IUB	2.	
	I	IVB	2	
	I	IDVT	16	
	I		20	
	I		18	
	I		19	
	I	INK	1	
		PHIN	90	
		XL	0.	
		R2IN	0.	
		BBAR	42.4	
		ABAR	60.	
		C11I	.8241758	06
			.8241758	06
		C12I	.2472527	06
			.2472527	06
		C22I	.8241758	06
			.8241758	06
		C33I	.38633241	03
			.38633241	03
			.38633241	03
			.38633241	03
		C34I	.11589972	03
			.11589972	03
			.11589972	03
			.11589972	03
		C44I	.38633241	03
			.38633241	03
			.38633241	03
			.38633241	03
		THI	.075	
			.075	
		DESTA	.2598	-3
		AM	.35672 1	
		HI	0.	
		DESTI	0.	
		PRI	20.	

SYMBOL	PRE	LOC.	VALUE	EXP
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WFORC	0.	
	END			

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X1

SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	8	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	4	
	I	IDVT	16	
	I		21	
	I		18	
	I		22	
	I		19	
	I		23	
	I	INK	2	
		PHIN	90.	
		XL	48.	
		R2IN	60.	
		BBAR	0.	
		ABAR	0.	
		C11I	1.31868	06
			1.31868	06
		C12I	.395604	06
			.395604	06
		C22I	1.31868	06
			1.31868	06
		C33I	1.5824176	03
			1.5824176	03
			1.5824176	03
			1.5824176	03
		C34I	.47472528	03
			.47472528	03
			.47472528	03
			.42472528	03
		C44I	1.5824176	03
			1.5824176	03
			1.5824176	03
			1.5824176	03
		THI	.12	
			.12	
		DESTA	.2588	-3
		AM	.561973	
		HI	24.	

SYMBOL	PRE	LOC.	VALUE	EXP
		DESTI	.32465277	-1
		PRI	20.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WFORC	40720.379	
	E	ND		

X1

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SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	-9	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	2	
	I	IDVT	21	
	I		24	
	I		22	
	I		23	
	I	INK	1	
		PHIN	110.	
		XL	0	
		R2IN	0	
		EBAR	-42.4	
		ABAR	60.	
		C11I	.87912	06
			.87912	06
		C12I	.263736	06
			.263736	06
		C22I	.87912	06
			.87912	06
		C33I	.46886447	03
			.46886447	03
			.46886447	03
			.46886447	03
		C34I	.14065934	03
			.14065934	03
			.14065934	03
			.14065934	03
		C44I	.46886447	03
			.46886447	03
			.46886447	03
			.46886447	03
		THI	.08	
			.08	
		DELTA	.2588	-3
		AM	0	
		HI	-24.	
		DELTI	.32465277	-1
		PHI	20.	

SYMBOL	PRE	LOC.	VALUE	EXP
		HE	0.	
		DELTE	0.	
		PRE	0.	
		WEARC	0.	
	E	ND		

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STL FORM 1602A VELLUM

SPACE TECHNOLOGY LABORATORIES
COMPUTATION AND DATA REDUCTION CENTER

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NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY WD

NO. OF CARDS _____ VERIFIED BY [illegible]

1	7	73
		X1

SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	10	
	I	IU	2	
	I	IV	2	
	I	IUE	2	
	I	IVB	1	
	I	IDUT	21	
	I		25	
	I		22	
	I		26	
	I		23	
	I		27	
	I	INK	2	
		PHIN	90.	
		XL	84.	
		K2IN	60.	
		[illegible]	[illegible]	
		ABAN	0.	
		C11I	1.64835	06
			1.64835	06
		C12I	.494505	06
			.494505	06
		C22I	1.64835	06
			1.64835	06
		C33I	.618	04
			.618	04
			.618	04
			.618	04
		C34I	.185	04
			.185	04
			.185	04
			.185	04
		C44I	.618	04
			.618	04
			.618	04
			.618	04
		THI	.15	
			.15	
		DELTA	.2588	-3
		AM	1.229317	
		PI	0.	

SYMBOL	PRE	LOC.	VALUE	EXP
		DESTI	0.	
		PRI	0.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WFARC	-62607.878	
	E	ND		

X1 AM

STL FORM 1602 BOND
STL FORM 1602A VELLUM REV. 12/62

SPACE TECHNOLOGY LABORATORIES
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NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

1	7	73

SYMBOL	PRE	LOC.	VALUE	EXP.
	I	INA	11	
	I	IU	2	
	I	IV	2	
	I	IUB	2	
	I	IVB	4	
	I	IDVT	21	
	I		28	
	I		22	
	I		29	
	I		23	
	I		30	
	I	INK	2	
		PHIN	110.	
		XL	-60.	
		R2IN	38.1618	
		RFAR	0.	
		AFAR	0.	
		C11I	1.64835	06
			1.64835	06
		C12I	.494505	06
			.494505	06
		C22I	1.64835	06
			1.64835	06
		C33I	3.0906593	03
			3.0906593	03
			3.0906593	03
			3.0906593	03
		C34I	.9271978	03
			.9271978	03
			.9271978	03
			.9271978	03
		C44I	3.0906593	03
			3.0906593	03
			3.0906593	03
			3.0906593	03
		THI	.15	
			.15	
		DESTA	.2588	-3
		AM	.764387	
		HI	0.	

SYMBOL	PRE	LOC.	VALUE	EXP
		DESTI	0.	
		PRI	0.	
		HE	0.	
		DESTE	0.	
		PRE	0.	
		WFARC	1695.3252	
		END		

STL FORM 1602 BOND REV. 12/62
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NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

1	7	73

SYMBOL	P/E	LOC.	VALUE	EXP.
b	I	INB	1	
	I	IDA1	-3	
	I	IDA2	4	
	I	IDA3	-5	
		HF	30.	
		DESTF	.13380276	-3
		FM	87368307	
	E	ND		
b	I	INB	2	
	I	IDA1	-7	
	I	IDA2	8	
	I	IDA3	-9	
		HF	24.	
		DESTF	.84019868	-4
		FM	0.	
	E	ND		

SYMBOL	P/E	LOC.	VALUE	EXP

STL FORM 1602 BOND
STL FORM 1602A VELLUM REV. 12/62

SPACE TECHNOLOGY LABORATORIES
COMPUTATION AND DATA REDUCTION CENTER

DATE _____ PAGE 14 OF 14

NAME _____ PRIORITY _____

PROBLEM NO. _____ KEYPUNCHED BY _____

NO. OF CARDS _____ VERIFIED BY _____

SYMBOL	PRE	LOC.	VALUE	EXP.
1	I	INC	1	
	I	IN	2	
	M	CK	10,10	
		02,02	1.0	3
	M	CM	10,10	
		01,01	12.939258	
	I	IDVTC	5	
	I		7	
	E	NO		
2	I	INC	2	
	I	IN	2	
	M	CK	10,10	
		02,02	1.0	3
	M	CM	10,10	
		01,01	1.293995	
	I	IDVTC	15	
	I		17	
	E	NO		
3	I	INC	3	
	I	IN	2	
	M	CK	10,10	
		02,02	1.0	3
	M	CM	10,10	
		01,01	1.293995	
	I	IDVTC	21	
	I		22	
	E	NO		
4	I	INC	4	
	I	IN	3	
	M	CK	10,10	
		02,02	1.0	3
		03,03	1.0	4
	M	CM	10,10	
		01,01	3.623188	
	I	IDVTC	28	
	I		27	
	I		30	
	E	NO		

STL FORM 1602 BOND REV. 12/62
STL FORM 1602A VELLUM

```
SYSPP2 IS NOT ASSIGNED. NO DUMP CAN BE TAKEN.
$DATE          051265
$ATTACH        A7
$AS            SYSLB2,H
$ATTACH        B7
$AS            SYSPP2,H
$EXECUTE       IBJOB
$IBJOB VERSION   3
$IBJOB T.W.    MAP
$IBLDR MAINF                                    MAIN0000
$IBLDR MATC                                     MATC0000
$IBLDR MATIV                                    MATI0000
$IBLDR MAT0                                     MAT00000
$IBLDR MAT1                                     MAT10000
$IBLDR MAT2                                     MAT20000
$IBLDR MAT3                                     MAT30000
$IBLDR MAT5                                     MAT50000
$IBLDR MAT6                                     MAT60000
$IBLDR MAT7                                     MAT70000
$IBLDR MAT8                                     MAT80000
$IBLDR MAT9                                     MAT90000
$IBLDR MATP                                     MATP0000
$IBLDR UNO9                                     UNO90000
$IBLDR UNO1                                     UNO10000
$IBLDR UNO2                                     UNO20000
$IBLDR BLDATA                                   BLDA0000
$IBLDR BLDAT1                                   BLDA0000
$IBLDR BLDAT2                                   BLDA0000
$IBLDR PROC                                     PROC0000
$IBLDR DASYS                                    DASY0000
$IBLDR DASH                                     DASH0000
$IBLDR DAFL                                     DAFL0000
$IBLDR DASM                                     DASM0000
$IBLDR TABLE                                    TABL0000
$IBLDR FUN2                                     FUN20000
$IBLDR FINP                                     FINP0000
$IBLDR SCNTL                                    SCNT0000
$IBLDR COMPK                                    CGMP0000
$IBLDR GENKM                                    GENK0000
$IBLDR GENUV                                    GENU0000
```

```
$IBLDR FCNTL                    FCNT0000
$IBLDR GENXI                    GENX0000
$IBLDR TABL1                    TABL0000
$IBLDR DIAGM                    DIAG0000
$IBLDR GENFM                    GENF0000
$IBLDR VVV                      VVV 0000
$IBLDR WWW                      WWW 0000
$IBLDR YYY                      YYY 0000
$IBLDR GENMB                    GENM0000
$IBLDR TOTKM                    TOTK0000
$IBLDR BUILD                    BUIL0000
$IBLDR EGCNT                    EGCN0000
$IBLDR FREQ                     FREQ0000
$IBLDR EG2FM                    EG2F0000
$IBLDR RCNTL                    RCNT0000
$IBLDR RESP1                    RESP0000
$IBLDR STRES                    STRE0000
```

T.W. IBLDR 05/12/65

OVERLAY ORIGIN CARDS AND ASSIGNED LINK NUMBERS

$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	1,	PARENT LINK IS	0
$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	2,	PARENT LINK IS	0
$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	3,	PARENT LINK IS	0
$ORIGIN	BETA,SYSLB2,REW	IS LINK	4,	PARENT LINK IS	3
$ORIGIN	BETA,SYSLB2,REW	IS LINK	5,	PARENT LINK IS	3
$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	6,	PARENT LINK IS	0
$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	7,	PARENT LINK IS	0
$ORIGIN	ALPHA,SYSLB2,REW	IS LINK	8,	PARENT LINK IS	0

T.W. IBLDR 05/12/65

M E M O R Y M A P

SYSTEM 00000 THRU 02715

FILE BLOCK ORIGIN 02716

NUMBER OF FILES - 7

1. UNIT09
2. UNIT01
3. UNIT02
4. UNIT03
5. UNIT04
6. UNIT05
7. UNIT06

FILE LIST ORIGIN 03042

PRE-EXECUTION INITIALIZATION 03060

CALL ON OBJECT PROGRAM 03111

OBJECT PROGRAM 03116 THRU 70155

1.	DECK -MAINF - *	03116	LINK NO. 0
2.	DECK -MATC - *	34777	0
3.	DECK -MATIV - *	35205	0
4.	DECK -MATO - *	35441	0
5.	DECK -MAT1 - *	35541	0
6.	DECK -MAT2 - *	35675	0
7.	DECK -MAT3 - *	36146	0
8.	DECK -MAT5 - *	36361	0
9.	DECK -MAT6 - *	36543	0
10.	DECK -MAT7 - *	37032	0
11.	DECK -MAT8 - *	37324	0
12.	DECK -MAT9 - *	37622	0
13.	DECK -MATP - *	40606	0

14.	DECK -UN09 -		41207	0
15.	DECK -UN01 -		41210	0
16.	DECK -UN02 -		41211	0
	OVERLAY COMMUNICATION		41212	0
17.	DECK -BLDATA-	*	57032	1
18.	DECK -BLDAT1-	*	57032	1
19.	DECK -BLDAT2-	*	57032	1
20.	DECK -PROC -	*	57032	1
21.	DECK -DASYS -	*	57072	1
22.	DECK -DASH -	*	57403	1
23.	DECK -DAFL -	*	57605	1
24.	DECK -DASM -	*	57721	1
25.	DECK -TABLE -	*	60116	1
26.	DECK -FUN2 -	*	62427	1
27.	DECK -FINP -	*	62623	1
28.	DECK -SCNTL -	*	57032	2
29.	DECK -COMPK -	*	57411	2

30.	DECK -GENKM -	*	60067	2
31.	DECK -GENUV -	*	63104	2
32.	DECK -FCNTL -	*	57032	3
33.	DECK -GENXI -	*	60744	4
34.	DECK -TABLI -	*	63124	4
35.	DECK -DIAGM -	*	63554	4
36.	DECK -GENFM -	*	60744	5
37.	DECK -VVV -	*	63502	5
38.	DECK -WWW -	*	63735	5
39.	DECK -YYY -	*	64142	5
40.	DECK -GENMB -	*	64310	5
41.	DECK -TOTKM -	*	57032	6
42.	DECK -BUILD -	*	66541	6
43.	DECK -EGCNT -	*	57032	7
44.	DECK -FREQ -	*	65701	7
45.	DECK -EG2FM -	*	66430	7
46.	DECK -RCNTL -	*	57032	8
47.	DECK -RESP1 -	*	62643	8
48.	DECK -STRES -	*	63343	8
49.	SUBR -.IBSYS-		00000	0
50.	SUBR -.IOEX -		00702	0
51.	SUBR -.JBCON-		02652	0
52.	SUBR -.LXCON-		41271	0
53.	SUBR -.IODEF-		41732	0
54.	SUBR -.LOVRY-	*	42151	0
55.	SUBR -.LXSL -	*	42530	0
56.	SUBR -.FPTRP-		42654	0
57.	SUBR -.ERAS.-		43064	0
58.	SUBR -XIT -		43070	0
59.	SUBR -FXEM -		43071	0
60.	SUBR -FOUT -		43513	0
61.	SUBR -FRWD -		44053	0
62.	SUBR -FRWB -		50577	0
63.	SUBR -UNO3 -		51546	0
64.	SUBR -UNO4 -		51547	0
65.	SUBR -UNO5 -		51550	0
66.	SUBR -UNO6 -		51551	0
67.	SUBR -FLOG -		51555	0

68.	SUBR -FXPF -	51716	0
69.	SUBR -FSCN -	52036	0
70.	SUBR -FSQR -	52247	0
71.	SUBR -FATN -	52354	0
72.	SUBR -FXP2 -	52562	0
73.	SUBR -FXP3 -	52700	0
74.	SUBR -FRWT -	53025	0
75.	SUBR -FSLDO -	53122	0
76.	SUBR -FSLBO -	53157	0
77.	SUBR -FSLO -	53215	0
78.	SUBR -.IOCS - *	53254	0
79.	SUBR -.IOCSM-	57032	0

(* - INSERTIONS OR DELETIONS MADE IN THIS DECK)

INPUT - OUTPUT BUFFERS	70156 THRU 77735
UNUSED CORE	77736 THRU 77777

```
HHEAD 1      MODAL RESPONSE FOR ONE STAGE LAUNCH VEHICLE
INC   30           INS   11           INF   2            INM   4
INC   0            G     1.0          IINS  -1           IIOPT11
IIOPT21            IIOPT30            IIOPT40            INEI  30
INP   3            END
IUBAR 2            IVBAR 2
MAPOLY11,11         01,011.0           02,031.0
MBPOLY11,11         01,021.0           02,031.0           END
IUBAR 2            IVBAR 4
MAPOLY11,11         01,011.0           02,021.0
MBPOLY11,11         01,011.0           02,021.0            03,031.0
 04,041.0          END
IUBAR 3            IVBAR 5
MAPOLY11,11         01,011.0           02,021.0            03,031.0
MBPOLY11,11         01,011.0           02,021.0            03,031.0
 04,041.0           05,051.0          END
IINA  -1           IIU   2            IIV   2            IIUB  2
IIVB  2            IIDVT 1            I     2            I     3
I     4            IINK  1             PHIN 69.444        XL    0.
 R2IN 0.            BBAR 18.0          ABAR 24.0          C11I .7692307  06
      .7692307  06 C12I .2307692  06       .2307692  06 C22I .7692307  06
      .7692307  06 C33I .31410256 03       .31410256 03       .31410256 03
      .31410256 03 C34I .94230769 02       .94230769 02       .94230769 02
      .94230769 02 C44I .31410256 03       .31410256 03       .31410256 03
      .31410256 03 THI  .07                .07           DESTA.2588     -3
 AM   0.            HI    0.           DESTI0.            PRI   0.
 HE   0.            DESTE0.            PRE   0.           WFORC0.
END
IINA  2            IIU   3            IIV   3            IIUB  3
IIVB  5            IIDVT 1            I     5            I     6
I     3            I     7            I     8            I     4
I     9            IINK  3             PHIN 69.444        XL    96.
 R2IN 60.           BBAR 0.            ABAR 0.            C11I .7692307  06
      .7692307  06 C12I .2307692  06       .2307692  06 C22I .7692307  06
      .7692307  06 C33I .31410256 03       .31410256 03       .31410256 03
      .31410256 03 C34I .94230769 02       .94230769 02       .94230769 02
      .94230769 02 C44I .31410256 03       .31410256 03       .31410256 03
      .31410256 03 THI  .07                .07           DESTA.2588     -3
 AM   .490146       HI    0.           DESTI0.            PRI   0.
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 HE   0.          DESTE0.          PRE  0.          WFORC-19.8
END
IINA  -3         IIU   2          IIV  2           IIUB 2
IIVB  2          IIDVT 6          I    10          I    8
I     9          IINK  1           PHIN 69.444       XL   0.
 R2IN 0.          BBAR 42.4        ABAR 60.          C11I .8241758  06
      .8241758  06 C12I .2472527  06      .2472527  06 C22I .8241758  06
      .8241758  06 C33I .38633241 03      .38633241 03      .38633241 03
      .38633241 03 C34I .11589972 03      .11589972 03      .11589972 03
      .11589972 03 C44I .38633241 03      .38633241 03      .38633241 03
      .38633241 03 THI  .075              .075         DESTA.2588     -3
 AM   0.          HI   0.          DESTI0.           PRI  20.
 HE   0.          DESTE0.          PRE  0.           WFORC0.
END
IINA  4          IIU   2          IIV  2           IIUB 2
IIVB  4          IIDVT 6          I    11          I    8
I     12         I     9          I    13          IINK 2
 PHIN 90.          XL   60.          R2IN 60.          BBAR 0.
 ABAR 0.          C11I 1.098901  06      1.098901  06 C12I .3296703  06
      .3296703  06 C22I 1.098901  06      1.098901  06 C33I .915750   03
      .915750   03      .915750   03      .915750   03 C34I .2747250  03
      .2747250  03      .2747250  03      .2747250  03 C44I .915750   03
      .915750   03      .915750   03      .915750   03 THI  .10
      .10          DESTA.2588     -3 AM   .585389          HI   30.
 DESTI.51701388 -1 PRI  20.           HE   0.              DESTE0.
 PRE  0.          WFORC-5347.022    END
IINA  -5         IIU   2          IIV  2           IIUB 2
IIVB  2          IIDVT 11         I    14          I    12
I     13         IINK  1           PHIN 90.          XL   0.
 R2IN 0.          BBAR -42.4       ABAR 60.          C11I .87912    06
      .87912    06 C12I .263736   06      .263736   06 C22I .87912    06
      .87912    06 C33I .46886447 03      .46886447 03      .46886447 03
      .46886447 03 C34I .14065934 03      .14065934 03      .14065934 03
      .14065934 03 C44I .46886447 03      .46886447 03      .46886447 03
      .46886447 03 THI  .08               .08          DESTA.2588     -3
 AM   .380503      HI   -30.          DESTI.51701388 -1 PRI  20.
 HE   0.          DESTE0.          PRE  0.           WFORC0.
END
IINA  6          IIU   3          IIV  3           IIUB 3
IIVB  5          IIDVT 11         I    15          I    16
I     12         I     17         I    18          I    13
```

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I      19          IINK  3           PHIN 90.          XL   108.
 R2IN 60.           BBAR 0.          ABAR 0.           C11I 1.64835   06
      1.64835   06 C12I .494505   06      .494505   06 C22I 1.64835   06
      1.64835   06 C33I .618      04      .618      04      .618      04
      .618      04 C34I .185      04      .185      04      .185      04
      .185      04 C44I .618      04      .618      04      .618      04
      .618      04 THI  .15                .15           DESTA.2588     -3
 AM   1.580557      HI   0.          DESTI0.           PRI  0.
 HE   0.           DESTE0.          PRE  0.           WFORC-39479.357
END
IINA  -7           IIU  2           IIV  2            IIUB 2
IIVB  2            IIDVT 16         I    20           I    18
I     19           IINK 1           PHIN 90           XL   0.
 R2IN 0.           BBAR 42.4        ABAR 60.          C11I .8241758  06
      .8241758  06 C12I .2472527  06      .2472527  06 C22I .8241758  06
      .8241758  06 C33I .38633241 03      .38633241 03      .38633241 03
      .38633241 03 C34I .11589972 03      .11589972 03      .11589972 03
      .11589972 03 C44I .38633241 03      .38633241 03      .38633241 03
      .38633241 03 THI  .075             .075          DESTA.2588     -3
 AM   .356721       HI   C.          DESTI0.           PRI  20.
 HE   0.           DESTE0.          PRE  0.           WFORC0.
END
IINA  8            IIU  2           IIV  2            IIUB 2
IIVB  4            IIDVT 16         I    21           I    18
I     22           I    19          I    23           IINK 2
 PHIN 90.          XL   48.          R2IN 60.          BBAR 0.
 ABAR 0.           C11I 1.31868   06      1.31868   06 C12I .395604   06
      .395604   06 C22I 1.31868   06      1.31868   06 C33I 1.5824176 03
      1.5824176 03      1.5824176 03      1.5824176 03 C34I .47472528 03
      .47472528 03      .47472528 03      .42472528 03 C44I 1.5824176 03
      1.5824176 03      1.5824176 03      1.5824176 03 THI  .12
      .12          DESTA.2588     -3 AM   .561973       HI   24.
 DESTI.32465277 -1 PRI  20.           HE   0.           DESTE0.
 PRE  0.           WFORC-40720.379  END
IINA  -9           IIU  2           IIV  2            IIUB 2
IIVB  2            IIDVT 21         I    24           I    22
I     23           IINK 1           PHIN 110.         XL   0
 R2IN 0            BBAR -42.4       ABAR 60.          C11I .87912    06
      .87912    06 C12I .263736   06      .263736   06 C22I .87912    06
      .87912    06 C33I .46886447 03      .46886447 03      .46886447 03
      .46886447 03 C34I .14065934 03      .14065934 03      .14065934 03
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      .14065934 03 C44I .46886447 03      .46886447 03      .46886447 03
      .46886447 03 THI  .08               .08          DESTA.2588     -3
 AM   0            HI   -24.         DESTI.32465277 -1 PRI  20.
 HE   0.           DESTE0.           PRE  0.           WFORC0.
END
IINA  10          IIU   2           IIV   2           IIUB  2
IIVB  4           IIDVT 21          I     25          I     22
I     26          I     23          I     27          IINK  2
 PHIN 90.          XL   84.          R2IN 60.          BBAR 0.
 ABAR 0.           C11I 1.64835   06       1.64835   06 C12I .494505   06
      .494505   06 C22I 1.64835   06       1.64835   06 C33I .618      04
      .618      04       .618      04       .618      04 C34I .185      04
      .185      04       .185      04       .185      04 C44I .618      04
      .618      04       .618      04       .618      04 THI  .15
      .15          DESTA.2588     -3 AM   1.229317       HI   0.
 DESTI0.           PRI  0.            HE   0.            DESTE0.
 PRE  0.           WFORC-62607.878   END
IINA  11          IIU   2           IIV   2           IIUB  2
IIVB  4           IIDVT 21          I     28          I     22
I     29          I     23          I     30          IINK  2
 PHIN 110.         XL   -60.          R2IN 38.1618      BBAR 0.
 ABAR 0.           C11I 1.64835   06       1.64835   06 C12I .494505   06
      .494505   06 C22I 1.64835   06       1.64835   06 C33I 3.0906593 03
      3.0906593 03       3.0906593 03       3.0906593 03 C34I .9271978  03
      .9271978  03       .9271978  03       .9271978  03 C44I 3.0906593 03
      3.0906593 03       3.0906593 03       3.0906593 03 THI  .15
      .15          DESTA.2588     -3 AM   .764387        HI   0.
 DESTI0.           PRI  0.            HE   0.            DESTE0.
 PRE  0.           WFORC1695.3252    END
IINB  1           IIDA1 -3          IIDA2 4           IIDA3 -5
 HF   30.          DESTF.13380276 -3 FM   87.368307     END
IINB  2           IIDA1 -7          IIDA2 8           IIDA3 -9
 HF   24.          DESTF.84019868 -4 FM   0.           END
IINC  1           IIN   2           MCK   10,10          02,021.0        3
MCM   10,10        01,0112.939958   IIDVTC5           I     7
END
IINC  2           IIN   2           MCK   10,10          02,021.0        3
MCM   10,10        01,011.293995    IIDVTC15          I     17
END
IINC  3           IIN   2           MCK   10,10          02,021.0        3
MCM   10,10        01,011.293995    IIDVTC21          I     22
```

```
END
IINC  4          IIN   3          MCK   10,10        02,021.0       3
 03,031.0       4 MCM   10,10       01,013.623188    IIDVTC28
I     29         I     30         END
```

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO -1

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.100000E 01	0.	-0.	0.
2	-0.	0.100000E 01	-0.	0.
3	-0.	0.	0.100000E 01	0.
4	0.166317E-10	-0.166317E-10	-0.	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER -1

EQUILIBRIUM CHECK = 0.

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.312524E 07			
2	-0.312524E 07	0.312524E 07		
3	-0.193901E 06	0.193901E 06	0.779103E 07	
4	-0.341233E 08	0.341233E 08	-0.703939E 08	0.116971E 10

MASS MATRIX FOR SHELL NUMBER -1

COMPUTED MASS = 0.50260160E-01

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.183371E-01			
2	0.751350E-02	0.168961E-01		
3	0.501185E-02	-0.501185E-02	0.375730E-01	
4	-0.507627E-01	0.507627E-01	-0.275367E-00	0.278907E 01

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 2

MATRIX 8 X 8

COL / ROW	1	2	3	4	5	6
1	0.100000E 01	0.	-0.	-0.	0.	-0.
2	0.444089E-15	1.000000E 00	0.444089E-15	-0.	0.	-0.
3	-0.	0.	0.100000E 01	-0.	0.	-0.
4	-0.	0.	-0.	0.100000E 01	0.	-0.596046E-07
5	-0.372528E-08	0.447034E-07	-0.298023E-07	-0.298023E-07	0.100000E 01	-0.931323E-07
6	-0.	0.	-0.	-0.	0.	1.000000E 00
7	0.762894E-09	-0.220421E-08	0.144131E-08	0.163620E-08	-0.498407E-08	0.171487E-08
8	-0.594108E-09	0.251252E-08	-0.137407E-08	-0.326601E-08	0.653202E-08	-0.272167E-08

COL / ROW	7	8
1	0.	-0.
2	0.	-0.
3	0.	-0.
4	-0.953674E-06	-0.190735E-05
5	0.476837E-06	-0.365823E-05
6	0.	-0.190735E-05
7	1.000000E 00	0.581937E-07
8	0.696749E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 2

EQUILIBRIUM CHECK = 0.

MATRIX 8 X 8

COL / ROW	1	2	3	4	5	6
1	0.300958E 07					
2	-0.372897E 07	0.988195E 07				
3	0.719388E 06	-0.615298E 07	0.543360E 07			
4	-0.164931E 07	0.195213E 07	-0.302820E 06	0.459824E 07		
5	0.476932E 06	-0.295835E 07	0.248142E 07	0.569060E 06	0.606828E 07	
6	0.204358E 06	0.364483E 06	-0.568842E 06	-0.452971E 06	-0.168613E 06	0.205126E 07
7	0.372248E 07	-0.487020E 07	0.114772E 07	-0.321997E 08	-0.944131E 07	0.817896E 07
8	0.996599E 07	-0.314388E 08	0.214728E 08	-0.103395E 08	0.377658E 07	0.199477E 08

COL / ROW	7	8
7	0.456877E 09	
8	0.188021E 09	0.471168E 09

MASS MATRIX FOR SHELL NUMBER 2

MASS CHECK = 0.99997934E 00

MATRIX 8 X 8

COL / ROW	1	2	3	4	5	6
1	0.449249E-01					
2	0.179846E-01	0.263162E-00				
3	-0.162288E-01	0.456177E-01	0.873124E-01			
4	0.554332E-02	-0.483479E-02	-0.708531E-03	0.697987E-01		
5	0.366774E-02	-0.933604E-02	0.566830E-02	0.204505E-01	0.199171E-00	
6	0.416803E-03	-0.103364E-01	0.991962E-02	-0.178942E-01	0.417901E-01	0.132484E-00
7	-0.593302E-01	0.365113E-01	0.228189E-01	-0.632856E 00	-0.194724E-00	0.316427E-00
8	-0.912712E-02	-0.912785E-01	0.100406E-00	-0.279916E-00	0.486807E-00	0.107099E 01

```
COL        7                  8
 ROW

  7   0.732956E 01
  8   0.466424E 01      0.113276E 02
```

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO -3

```
 MATRIX       4 X   4

COL        1                  2                  3                  4
 ROW

  1   0.100000E 01      0.                -0.                0.
  2  -0.                0.100000E 01      -0.                0.
  3  -0.                0.                 0.100000E 01      0.
  4   0.749979E-10     -0.749979E-10      -0.                1.000000E 00
```

STIFFNESS MATRIX FOR SHELL NUMBER -3

EQUILIBRIUM CHECK = 0.

```
 MATRIX       4 X   4

COL        1                  2                  3                  4
 ROW

  1   0.379563E 07
  2  -0.379563E 07      0.379563E 07
  3  -0.327502E 06      0.327502E 06      0.791540E 07
  4  -0.838903E 08      0.838903E 08     -0.152049E 09      0.562453E 10
```

MASS MATRIX FOR SHELL NUMBER -3

COMPUTED MASS = 0.32772276E-00

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.111255E-00			
2	0.484484E-01	0.119571E-00		
3	0.331031E-01	-0.331031E-01	0.236799E-00	
4	-0.733303E 00	0.733303E 00	-0.386021E 01	0.855118E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 4

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.100000E 01	-0.	-0.	0.	0.	0.
2	-0.	0.100000E 01	-0.	0.	0.	0.
3	-0.	-0.	0.100000E 01	0.	0.	0.
4	-0.	-0.	-0.	0.100000E 01	0.	0.
5	-0.	-0.	-0.	0.	0.100000E 01	0.158946E-07
6	-0.	-0.	-0.	0.	-0.238419E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 4

EQUILIBRIUM CHECK = 0.

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6

1	0.690460E 07					
2	-0.690460E 07	0.690460E 07				
3	-0.103569E 07	0.103569E 07	0.256448E 07			
4	-0.103569E 07	0.103569E 07	0.887822E 06	0.256448E 07		
5	0.103569E 08	-0.103569E 08	-0.217002E 08	-0.128228E 08	0.236709E 09	
6	-0.103569E 08	0.103569E 08	0.128228E 08	0.217002E 08	-0.177525E 09	0.236709E 09

MASS MATRIX FOR SHELL NUMBER 4

MASS CHECK = 0.99999526E 00

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.195130E-00					
2	0.975648E-01	0.195130E-00				
3	-0.	-0.	0.217430E-00			
4	-0.	-0.	0.752643E-01	0.217430E-00		
5	0.	0.	-0.183979E 01	-0.108715E 01	0.200705E 02	
6	-0.	-0.	0.108715E 01	0.183979E 01	-0.150529E 02	0.200705E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO -5

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.100000E 01	-0.	-0.	-0.
2	-0.	0.100000E 01	-0.	-0.
3	-0.	-0.	0.100000E 01	-0.
4	0.	0.	0.	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER -5

EQUILIBRIUM CHECK = 0.

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.659387E 07			
2	-0.659387E 07	0.659387E 07		
3	0.215740E 07	-0.215740E 07	0.640335E 07	
4	-0.126904E 08	0.126904E 08	0.737568E 08	0.133519E 10

MASS MATRIX FOR SHELL NUMBER -5

MASS CHECK = 0.10014228E 01

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.773877E-01			
2	0.559913E-01	0.191133E-00		
3	-0.	-0.	0.218207E-00	
4	-0.	-0.	0.233553E 01	0.319387E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 6

MATRIX 8 X 8

COL	1	2	3	4	5	6

ROW						
1	0.100000E 01	0.	0.	-0.	0.	-0.
2	0.444089E-15	1.000000E 00	0.444089E-15	-0.	0.	-0.
3	0.	0.	0.100000E 01	-0.	0.	-0.
4	0.	0.	0.	0.100000E 01	0.	-0.
5	0.	0.	0.	0.111759E-07	0.100000E 01	-0.819564E-07
6	0.	0.	0.	0.596046E-07	0.	0.100000E 01
7	0.	0.	0.	0.333724E-08	-0.400124E-08	0.452726E-08
8	0.	0.	0.	-0.386326E-08	0.551895E-08	-0.441516E-08

COL / ROW	7	8
1	0.	-0.
2	0.	-0.
3	0.	-0.
4	-0.953674E-06	-0.
5	-0.834465E-06	-0.184774E-05
6	0.	-0.
7	1.000000E 00	0.113742E-06
8	0.176606E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 6

EQUILIBRIUM CHECK = 0.

MATRIX 8 X 8

COL / ROW	1	2	3	4	5	6
1	0.134256E 08					
2	-0.153435E 08	0.306871E 08				
3	0.191794E 07	-0.153435E 08	0.134256E 08			
4	-0.196781E 07	0.248565E 07	-0.517844E 06	0.384608E 07		
5	-0.165710E 07	0.155594E 01	0.165710E 07	0.118434E 07	0.757393E 07	
6	0.517845E 06	-0.248565E 07	0.196781E 07	-0.680527E 06	0.118434E 07	0.384608E 07
7	0.167782E 08	-0.223709E 08	0.559271E 07	-0.319568E 08	-0.127811E 08	0.111816E 08
8	0.559273E 07	-0.223709E 08	0.167782E 08	-0.111816E 08	0.127811E 08	0.319568E 08

COL / ROW	7	8
7	0.344983E 09	
8	0.172446E 09	0.344984E 09

MASS MATRIX FOR SHELL NUMBER 6

MASS CHECK = 0.99999949E 00

MATRIX 8 X 8

COL / ROW	1	2	3	4	5	6
1	0.210741E-00					
2	0.105370E-00	0.842964E 00				
3	-0.526853E-01	0.105371E-00	0.210741E-00			
4	0.	0.	0.	0.326147E-00		
5	0.	0.	0.	0.100352E-00	0.642260E 00	
6	-0.	-0.	-0.	-0.577025E-01	0.100352E-00	0.326147E-00
7	-0.	-0.	-0.	-0.270953E 01	-0.108380E 01	0.948326E 00
8	-0.	-0.	-0.	-0.948321E 00	0.108377E 01	0.270955E 01

COL / ROW	7	8
7	0.292629E 02	
8	0.146312E 02	0.292636E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO -7

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.100000E 01	-0.	-0.	0.
2	-0.	0.100000E 01	-0.	0.
3	-0.	-0.	0.100000E 01	0.
4	-0.	-0.	-0.	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER -7

EQUILIBRIUM CHECK = 0.

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.618181E 07			
2	-0.618181E 07	0.618181E 07		
3	-0.202252E 07	0.202252E 07	0.600319E 07	
4	-0.118963E 08	0.118963E 08	-0.691463E 08	0.125184E 10

MASS MATRIX FOR SHELL NUMBER -7

MASS CHECK = 0.10014213E 01

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.725508E-01			
2	0.524918E-01	0.179187E-00		
3	-0.	-0.	0.204569E-00	
4	0.	0.	-0.218955E 01	0.299424E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 8

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.100000E 01	-0.	-0.	0.	0.	0.
2	-0.	0.100000E 01	-0.	0.	0.	0.
3	-0.	-0.	0.100000E 01	0.	0.	0.
4	-0.	-0.	-0.	0.100000E 01	0.	0.
5	-0.	-0.	-0.139698E-08	0.139698E-08	0.100000E 01	0.285606E-07
6	-0.	-0.	0.124176E-08	-0.124176E-08	-0.198682E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 8

EQUILIBRIUM CHECK = 0.

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6

1	0.103569E 08					
2	-0.103569E 08	0.103569E 08				
3	-0.124283E 07	0.124283E 07	C.246103E 07			
4	-0.124283E 07	0.124283E 07	C.853177E 06	0.246103E 07		
5	0.994261E 07	-0.994261E 07	-C.166632E 08	-C.985044E 07	0.145235E 09	
6	-0.994261E 07	0.994261E 07	C.985044E 07	0.166632E 08	-0.108995E 09	0.145235E 09

MASS MATRIX FOR SHELL NUMBER 8

MASS CHECK = 0.99999444E 00

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.187324E-00					
2	0.936622E-01	0.187324E-00				
3	-0.	-0.	0.208733E-00			
4	-0.	-0.	0.722537E-01	0.208733E-00		
5	0.	0.	-C.141296E 01	-C.834931E 00	0.123313E 02	
6	-0.	-0.	C.834931E 00	C.141296E 01	-0.924847E 01	0.123313E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NC -9

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.100000E 01	-0.	-C.	-C.
2	0.	0.100000E 01	-C.	-C.
3	0.	-0.	0.100000E 01	-0.
4	0.171220E-09	-0.171220E-09	0.	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER -9

EQUILIBRIUM CHECK = 0.

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.101947E 08			
2	-0.101947E 08	0.101947E 08		
3	0.155648E 07	-0.155648E 07	0.636730E 07	
4	-0.614921E 08	0.614921E 08	0.364779E 08	0.769639E 09

MASS MATRIX FOR SHELL NUMBER -9

COMPUTED MASS = 0.29963668E-00

MATRIX 4 X 4

COL / ROW	1	2	3	4
1	0.577495E-01			
2	0.361943E-01	0.169499E-00		
3	-0.280732E-01	0.280732E-01	0.159477E-00	
4	-0.250751E-00	0.250751E-00	0.114550E 01	0.102317E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 10

MATRIX 6 X 6

COL	1	2	3	4	5	6

ROW

1	0.100000E 01	-0.	-0.	0.	0.	0.
2	-0.	0.100000E 01	-0.	0.	0.	0.
3	-0.	-0.	0.100000E 01	0.	0.	0.
4	-0.	-0.	-0.	0.100000E 01	0.	0.
5	-0.	-0.	-0.	0.	0.100000E 01	0.227065E-07
6	-0.	-0.	-0.	0.	-0.227065E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 10

EQUILIBRIUM CHECK = 0.

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.739778E 07					
2	-0.739778E 07	0.739778E 07				
3	-0.155353E 07	0.155353E 07	0.538473E 07			
4	-0.155353E 07	0.155353E 07	0.186509E 07	0.538473E 07		
5	0.217495E 08	-0.217495E 08	-0.637942E 08	-0.377034E 08	0.973786E 09	
6	-0.217495E 08	0.217495E 08	0.377034E 08	0.637941E 08	-0.730551E 09	0.973785E 09

MASS MATRIX FOR SHELL NUMBER 10

MASS CHECK = 0.99999532E 00

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.409772E-00					

2	0.204886E-00	0.409772E-00				
3	-0.	-0.	0.456603E-00			
4	-0.	-0.	0.158055E-00	0.456603E-00		
5	0.	0.	-0.540899E 01	-0.319622E 01	0.826101E 02	
6	-0.	-0.	0.319622E 01	0.540899E 01	-0.619576E 02	0.826101E 02

INVERSE CHECK FOR TRANSFORMATION MATRIX T X T INVERSE SHELL NO 11

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.100000E 01	-0.	-0.	0.	0.	0.
2	0.	0.100000E 01	-0.	0.	0.	0.
3	0.	-0.	0.100000E 01	0.	0.	0.
4	0.	-0.	-0.	0.100000E 01	0.	0.
5	0.328271E-09	-0.328271E-09	-0.850144E-09	0.850144E-09	0.100000E 01	0.403206E-07
6	-0.379446E-09	0.379446E-09	0.877204E-09	-0.877204E-09	-0.280705E-07	1.000000E 00

STIFFNESS MATRIX FOR SHELL NUMBER 11

EQUILIBRIUM CHECK = 0.

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.706321E 07					
2	-0.706321E 07	0.706321E 07				
3	0.942325E 06	-0.942325E 06	0.454506E 07			
4	-0.382485E 07	0.382485E 07	0.626544E 06	0.790453E 07		
5	0.262514E 08	-0.262514E 08	-0.495042E 08	-0.240912E 08	0.120107E 10	
6	-0.200304E 08	0.200304E 08	0.202896E 08	0.602430E 08	-0.590113E 09	0.114053E 10

MASS MATRIX FOR SHELL NUMBER 11

MASS CHECK = 0.99999981E 00

MATRIX 6 X 6

COL / ROW	1	2	3	4	5	6
1	0.283620E-00					
2	0.126916E-00	0.226935E-00				
3	-0.699331E-02	0.699331E-02	0.317926E-00			
4	0.493015E-02	-0.493015E-02	0.982783E-01	0.249904E-00		
5	0.550235E-01	-0.550235E-01	-0.294070E 01	-0.158012E 01	0.354805E 02	
6	0.349965E-01	-0.349965E-01	0.163514E 01	0.250052E 01	-0.252084E 02	0.317417E 02

MASS MATRIX FOR FLUID NUMBER 1

MASS CHECK = 0.99085022E 00

MATRIX 14 X 14

COL / ROW	1	2	3	4	5	6
1	0.					
2	0.	0.				
3	0.	0.	0.			
4	0.	0.	0.	0.		
5	0.	0.	0.	0.	0.	
6	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	-0.	-0.	-0.	-0.	-0.	-0.
10	0.	0.	0.	0.	0.	0.

11 12 13 14

COL / ROW	7	8	9	10	11	12
7	0.157083E 01					
8	0.442688E 01	0.270611E 02				
9	-0.257128E 02	-0.754985E 02	0.422216E 03			
10	0.463300E 02	0.201076E 03	-0.779167E 03	0.177873E 04		
11	-0.487510E-00	-0.438759E 01	0.853143E 01	-0.28C318E 02	0.355738E 01	
12	-0.176165E 01	-0.158548E 02	0.308288E 02	-0.101295E 03	0.124460E 02	0.589188E 02
13	0.202112E 01	0.181901E 02	-0.353696E 02	0.116214E 03	-0.140296E 02	-0.472142E 02
14	0.212454E 02	0.191208E 03	-0.371794E 03	0.122161E 04	-0.155667E 03	-0.564181E 03

COL / ROW	13	14
13	0.583458E 02	
14	0.607522E 03	0.685300E 04

MASS MATRIX FOR FLUID NUMBER 2

COMPUTED MASS = 0.39036833E 02

MATRIX 14 X 14

COL / ROW	1	2	3	4	5	6
1	0.					
2	0.	0.				
3	0.	0.	0.			
4	0.	0.	0.	0.		
5	0.	0.	0.	0.	0.	
6	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	-0.	-0.	-0.	-0.	-0.	-0.
10	0.	0.	0.	0.	0.	0.
11	-0.	-0.	-0.	-0.	-0.	-0.
12	-0.	-0.	-0.	-0.	-0.	-0.
13	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.

COL / ROW	7	8	9	10	11	12
7	0.751596E 00					
8	0.196420E 01	0.115882E 02				
9	-0.981193E 01	-0.267230E 02	0.128494E 03			
10	0.170989E 02	0.697000E 02	-0.229361E 03	0.508713E 03		
11	-0.313503E-00	-0.282153E 01	0.438904E 01	-0.144211E 02	0.443369E 01	
12	-0.598736E 00	-0.538862E 01	0.838230E 01	-0.275418E 02	0.701515E 01	0.205729E 02
13	0.506266E 00	0.455640E 01	-0.708773E 01	0.232882E 02	-0.718083E 01	-0.107075E 02
14	0.348144E 01	0.313330E 02	-0.487402E 02	C.160146E 03	-0.485783E 02	-0.866990E 02

COL / ROW	13	14
13	0.118360E 02	
14	0.762819E 02	0.561351E 03

TOTAL STIFFNESS MATRIX

MATRIX 30 X 30

COL / ROW	1	2	3	4	5	6
1	0.613482E 07					
2	-0.312524E 07	0.312524E 07				
3	-0.184321E 07	0.193901E 06	0.123893E 08			
4	-0.304008E 08	0.341233E 08	-0.102594E 09	0.162659E 10		
5	-0.372897E 07	0.	0.195213E 07	-0.487020E 07	0.988195E 07	
6	0.719388E 06	0.	-0.302820E 06	0.114772E 07	-0.615298E 07	0.161338E 08
7	0.476932E 06	0.	0.569060E 06	-0.944131E 07	-0.295835E 07	0.248142E 07
8	0.204358E 06	0.	-0.452971E 06	0.817896E 07	0.364483E 06	-0.193203E 07
9	0.996599E 07	0.	-0.103395E 08	0.188021E 09	-0.314388E 08	-0.520606E 08
10	0.	0.	0.	0.	0.	-0.379563E 07
11	0.	0.	0.	0.	0.	-0.690460E 07
12	0.	0.	0.	0.	0.	-0.103569E 07
13	0.	0.	0.	0.	0.	-0.103569E 08
14	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	7	8	9	10	11	12
7	0.606928E 07					
8	-0.168613E 06	0.125311E 08				
9	0.377658E 07	-0.153802E 09	0.633241E 10			
10	0.	0.327502E 06	0.838903E 08	0.379563E 07		
11	0.	0.103569E 07	-0.103569E 08	0.	0.269241E 08	
12	0.	0.887822E 06	-0.128228E 08	0.	0.122528E 07	0.128139E 08
13	0.	0.128228E 08	-0.177525E 09	0.	0.144446E 08	0.635002E 08
14	0.	0.	0.	0.	-0.659387E 07	-0.215740E 07
15	0.	0.	0.	0.	-0.153435E 08	0.248565E 07
16	0.	0.	0.	0.	0.191794E 07	-0.517844E 06
17	0.	0.	0.	0.	-0.165710E 07	0.118434E 07
18	0.	0.	0.	0.	0.517845E 06	-0.680527E 06
19	0.	0.	0.	0.	0.559273E 07	-0.111816E 08
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	13	14	15	16	17	18
13	0.191688E 10					
14	0.126904E 08	0.659387E 07				
15	-0.223709E 08	0.	0.306871E 08			
16	0.559271E 07	0.	-0.153435E 08	0.299643E 08		
17	-0.127811E 08	0.	0.155594E 01	0.165710E 07	0.757493E 07	
18	0.111816E 08	0.	-0.248565E 07	-0.129754E 07	0.118434E 07	0.123103E 08
19	0.172446E 09	0.	-0.223709E 08	0.148245E 08	0.127811E 08	-0.538527E 08
20	0.	0.	0.	-0.618181E 07	0.	0.202252E 07
21	0.	0.	0.	-0.103569E 08	0.	0.124283E 07
22	0.	0.	0.	-0.124283E 07	0.	0.853177E 06
23	0.	0.	0.	-0.994261E 07	0.	0.985044E 07
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	19	20	21	22	23	24
19	0.174206E 10					
20	0.118963E 08	0.618181E 07				
21	-0.994261E 07	0.	0.350126E 08			
22	-0.985044E 07	0.	0.218810E 07	0.187591E 08		
23	-0.108995E 09	0.	-0.354867E 07	-0.601572E 08	0.308973E 10	
24	0.	0.	-0.101947E 08	-0.155648E 07	0.614921E 08	0.101947E 08
25	0.	0.	-0.739778E 07	0.155353E 07	-0.217495E 08	0.
26	0.	0.	-0.155353E 07	0.186509E 07	-0.377034E 08	0.
27	0.	0.	-0.217495E 08	0.377034E 08	-0.730551E 09	0.
28	0.	0.	-0.706321E 07	-0.942325E 06	-0.262514E 08	0.
29	0.	0.	-0.382485E 07	0.626544E 06	-0.240912E 08	0.
30	0.	0.	-0.200304E 08	0.202896E 08	-0.590113E 09	0.

COL / ROW	25	26	27	28	29	30
25	0.739778E 07					
26	0.155353E 07	0.538473E 07				
27	0.217495E 08	0.637941E 08	0.973785E 09			
28	0.	0.	0.	0.706321E 07		
29	0.	0.	0.	0.382485E 07	0.790553E 07	
30	0.	0.	0.	0.200304E 08	0.602430E 08	0.114054E 10

TOTAL MASS MATRIX

MATRIX 30 X 30

COL / ROW	1	2	3	4	5	6
1	0.632620E-01					
2	0.751350E-02	0.168961E-01				
3	0.105552E-01	-0.501185E-02	0.107372E-00			
4	-0.110093E-00	0.507627E-01	-0.908223E 00	0.101186E 02		
5	0.179846E-01	0.	-0.483479E-02	0.365113E-01	0.132031E 02	
6	-0.162288E-01	0.	-0.708531E-03	0.228189E-01	0.456177E-01	0.393697E-00
7	0.366774E-02	0.	0.204505E-01	-0.194724E-00	-0.933604E-02	0.566830E-02
8	0.416803E-03	0.	-0.178942E-01	0.316427E-00	-0.103364E-01	0.430227E-01
9	-0.912712E-02	0.	-0.279916E-00	0.466424E 01	-0.912785E-01	-0.632898E 00
10	0.	0.	0.	0.	0.	0.484484E-01
11	0.	0.	0.	0.	0.	0.975648E-01
12	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	7	8	9	10	11	12
7	0.199171E-00					
8	0.417901E-01	0.215754E 01				
9	0.486807E-00	-0.303419E 02	0.539126E 03			
10	0.	-0.331031E-01	0.733303E 00	0.119571E-00		
11	0.	-0.487510E-00	0.853143E 01	0.	0.404064E 01	
12	0.	0.652326E 01	-0.111955E 03	0.	-0.184172E 02	0.122549E 03
13	0.	0.686625E 02	-0.116601E 04	0.	-0.183699E 03	0.111749E 04
14	0.	-0.176165E 01	0.308288E 02	0.	0.125020E 02	-0.630690E 02
15	0.	0.	0.	0.	0.105370E-00	0.
16	0.	0.	0.	0.	-0.526853E-01	0.
17	0.	0.	0.	0.	0.	0.100352E-00
18	0.	0.	0.	0.	0.	-0.577025E-01
19	0.	0.	0.	0.	0.	-0.948321E 00
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	13	14	15	16	17	18
13	0.111562E 05					
14	-0.665475E 03	0.591100E 02				
15	0.	0.	0.213696E 01			
16	0.	0.	0.105371E-00	0.470616E-00		
17	-0.108380E 01	0.	0.	0.	0.642260E 00	
18	0.948326E 00	0.	0.	0.	0.100352E-00	0.149105E 01
19	0.146312E 02	0.	0.	0.	0.108377E 01	-0.107049E 02
20	0.	0.	0.	0.524918E-01	0.	0.
21	0.	0.	0.	0.936622E-01	0.	-0.313503E-00
22	0.	0.	0.	0.	0.	0.254272E 01
23	0.	0.	0.	0.	0.	0.214153E 02
24	0.	0.	0.	0.	0.	-0.598736E 00
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.

COL / ROW	19	20	21	22	23	24
19	0.200032E 03					
20	0.	0.179187E-00				
21	0.438904E 01	0.	C.666615E 01			
22	-0.346456E 02	0.	-0.100374E 02	C.336797E 02		
23	-0.287350E 03	0.	-C.631952E 02	0.194812E 03	0.153101E 04	
24	0.838230E 01	0.	C.705134E 01	-0.160681E 02	-0.113990E 03	0.207424E 02
25	0.	0.	C.204886E-00	C.	0.	0.
26	0.	0.	0.	C.158055E-00	-0.319622E 01	0.
27	0.	0.	0.	0.319622E 01	-0.619576E 02	0.
28	0.	0.	0.126916E-00	0.699331E-02	-0.550235E-01	0.
29	0.	0.	C.493015E-02	C.982783E-01	-0.158012E 01	0.
30	0.	0.	0.349965E-01	0.163514E 01	-0.252084E 02	0.

COL / ROW	25	26	27	28	29	30
25	0.409772E-00					
26	0.	0.456603E-00				
27	0.	0.540899E 01	0.826101E 02			
28	0.	0.	0.	0.385012E 01		
29	0.	0.	0.	-0.493015E-02	0.249904E-00	
30	0.	0.	0.	-0.349965E-01	0.250052E 01	0.317417E 02

MODAL RESPONSE FOR ONE STAGE LAUNCH VEHICLE

MODAL SUMMARY DATA

1. NATURAL FREQUENCIES IN CYCLES PER SECOND

MATRIX 30 X 1

COL / ROW	1
1	0.254409E-01
2	0.376658E 02
3	0.599973E 02
4	0.831148E 02
5	0.114812E 03
6	0.177224E 03
7	0.225478E 03
8	0.290272E 03
9	0.376340E 03
10	0.450331E 03
11	0.470279E 03
12	0.476231E 03
13	0.512283E 03
14	0.539815E 03
15	0.545882E 03
16	0.552770E 03
17	0.692154E 03
18	0.738451E 03
19	0.790439E 03
20	0.838487E 03
21	0.864993E 03
22	0.915462E 03
23	0.950234E 03
24	0.107980E 04
25	0.136733E 04
26	0.152877E 04
27	0.165950E 04
28	0.171815E 04
29	0.196891E 04
30	0.375346E 04

2. MODE SHAPES

MATRIX 30 X 30

COL / ROW	1	2	3	4	5	6
1	-0.810618E-01	0.110490E-02	-0.250764E-00	0.122839E-00	0.355770E-01	-0.221760E-02
2	-0.810618E-01	0.134481E-02	-0.246673E-00	0.119761E-00	0.341935E-01	-0.207085E-02
3	0.335764E-07	-0.151726E-03	-0.187998E-02	0.128776E-02	0.583844E-03	-0.638151E-04
4	0.500507E-08	-0.210598E-04	-0.389283E-03	0.298173E-03	0.136335E-03	-0.149704E-04
5	-0.810618E-01	0.126199E-02	-0.232771E-00	0.107302E-00	0.278758E-01	-0.132351E-02
6	-0.810618E-01	0.116238E-02	-0.128913E-00	0.143152E-01	-0.180441E-01	0.399673E-02
7	0.167465E-07	0.622677E-04	-0.415541E-01	0.371944E-01	0.185565E-01	-0.218288E-02
8	-0.583948E-07	0.120685E-02	-0.652306E-02	0.406453E-02	0.339824E-02	-0.105895E-03
9	-0.101974E-09	0.103132E-04	-0.477255E-03	0.626202E-03	0.296808E-03	-0.500986E-04
10	-0.810618E-01	0.832137E-03	-0.118572E-00	0.199207E-03	-0.254195E-01	0.537552E-02
11	-0.810618E-01	0.479761E-02	-0.530067E-01	-0.249173E-01	-0.440852E-01	0.636007E-02
12	-0.109029E-07	-0.568661E-02	-0.492615E-01	-0.138611E-00	0.230395E-01	-0.240439E-02
13	0.432942E-09	-0.206258E-02	-0.161955E-02	0.232466E-02	-0.288176E-02	0.344800E-03
14	-0.810617E-01	0.443969E-01	-0.358774E-01	-0.145671E-00	0.102530E-01	-0.491741E-03
15	-0.810619E-01	-0.244291E-01	-0.319689E-01	-0.545166E-02	-0.920248E-01	0.115003E-01
16	-0.810619E-01	-0.535819E-01	-0.142021E-01	-0.493268E-02	-0.129285E-00	0.140477E-01
17	0.156927E-07	0.795087E-02	-0.191778E-02	0.280904E-01	0.622690E-02	-0.894099E-03
18	0.157832E-07	0.901412E-02	-0.654630E-02	-0.227103E-01	0.144960E-01	-0.161981E-01
19	0.247004E-08	0.522026E-03	-0.404051E-03	-0.202715E-02	0.150578E-02	0.148481E-02
20	-0.810619E-01	-0.576547E-01	-0.113466E-01	0.643803E-02	-0.139602E-00	0.172581E-01
21	-0.810620E-01	-0.864702E-01	0.741594E-02	-0.154605E-02	-0.136432E-00	0.340739E-01
22	0.936091E-08	0.134780E-01	-0.110745E-01	-0.201749E-02	-0.116744E-00	-0.163737E-00
23	0.210343E-08	0.166272E-02	-0.128815E-02	-0.211398E-03	-0.941911E-02	0.311171E-02
24	-0.810620E-01	-0.112893E-00	0.263886E-01	0.123649E-02	-0.716385E-01	-0.196393E-00
25	-0.810620E-01	-0.868486E-01	0.753988E-02	-0.155657E-02	-0.138598E-00	0.614439E-01
26	-0.979690E-08	-0.720453E-02	0.528215E-02	0.769831E-03	0.210159E-01	-0.111688E-00
27	0.125838E-08	0.120603E-02	-0.886453E-03	-0.130674E-03	-0.387240E-02	0.153088E-01
28	-0.810620E-01	-0.807161E-01	0.118270E-03	-0.353400E-02	-0.329968E-00	0.297998E-00
29	-0.577683E-09	-0.459422E-02	0.517086E-02	0.129687E-02	0.117675E-00	-0.179263E-00
30	0.221465E-09	0.761769E-03	-0.613430E-03	-0.106607E-03	-0.553481E-02	0.878580E-02

COL / ROW	7	8	9	10	11	12
1	0.594381E-01	0.282074E-01	0.479788E-01	-0.939167E-03	-0.217340E-00	0.203901E-00
2	0.514600E-01	0.371163E-01	0.720129E-01	0.391543E-01	-0.103032E-01	0.102352E-00
3	0.392866E-02	-0.572741E-02	-0.165533E-01	-0.300967E-01	-0.165623E-00	0.856340E-01
4	0.786965E-03	-0.702272E-03	-0.185050E-02	-0.335198E-02	-0.185111E-01	0.968612E-02
5	0.266098E-01	0.132732E-01	0.171254E-01	0.784365E-02	0.112885E-01	0.571173E-02
6	-0.161438E-00	-0.116410E-00	-0.313513E-00	-0.236322E-00	-0.327935E-00	-0.275089E-00
7	0.760924E-01	0.627441E-01	0.165533E-00	0.140160E-00	0.296336E-00	0.638553E-01
8	-0.539499E-01	0.103634E-00	0.103280E-00	0.818015E-01	0.784572E 00	-0.668428E 00
9	0.324637E-02	0.808956E-03	0.871087E-02	0.124471E-01	0.350241E-01	0.800330E-03
10	-0.246022E-00	-0.168296E-00	-0.646899E 00	-0.707544E 00	-0.166486E 01	-0.296628E-00
11	-0.199628E-00	-0.173270E-00	-0.274818E-00	-0.779164E-01	-0.683304E-02	-0.688158E-01
12	0.215414E-00	-0.151594E-00	-0.651460E-01	-0.186496E-01	0.404258E-01	-0.945568E-01
13	-0.303954E-01	0.181483E-01	0.658109E-02	0.331772E-02	-0.755292E-02	0.201583E-01
14	-0.736011E-01	0.936713E-01	0.687753E-01	0.315785E-01	-0.360666E-01	0.123540E-00
15	-0.257384E-00	-0.306962E-00	-0.268424E-00	0.502347E-01	0.185602E-00	0.175339E-00
16	-0.177558E-00	-0.316645E-00	-0.299762E-01	0.184016E-00	0.103024E-00	0.112760E-00
17	-0.110840E-00	0.119617E-00	-0.449111E-01	-0.996720E-01	-0.173196E-00	-0.156703E-00
18	0.539972E-01	-0.110152E-00	-0.249165E-01	-0.548905E 00	0.296073E-00	0.210214E-00
19	0.688026E-02	-0.259405E-02	-0.188134E-01	0.931859E-02	0.901574E-02	0.454028E-02
20	-0.224555E-00	-0.314923E-00	0.154634E-01	0.466420E-00	-0.475894E-02	0.591777E-01
21	-0.552672E-01	-0.188116E-00	0.222118E-00	0.125368E-00	-0.798923E-01	-0.689198E-01
22	0.252608E-01	0.421870E-01	-0.876980E-01	0.186870E-00	-0.318076E-01	-0.260953E-01
23	-0.232630E-02	-0.992039E-02	0.192083E-01	-0.166463E-01	-0.791323E-03	-0.963528E-03
24	0.443684E-01	0.680363E-01	-0.429388E-01	-0.261683E-01	0.802750E-02	0.617437E-02
25	-0.725000E-01	-0.278390E-00	0.452217E-00	0.267516E-00	-0.295860E-00	-0.289931E-00
26	0.345116E-01	0.118280E-00	-0.252967E-00	0.188746E-00	0.784320E-01	0.917617E-01
27	-0.452082E-02	-0.140186E-01	0.246155E-01	-0.420181E-01	0.140964E-01	0.147983E-01
28	0.112482E-00	0.146077E-00	-0.904096E-01	-0.183844E-01	0.164836E-01	0.139702E-01
29	-0.969994E-01	-0.192881E-00	0.172363E-00	0.151213E-00	-0.738707E-01	-0.634217E-01
30	0.278720E-03	-0.228640E-02	0.825771E-02	-0.123773E-01	0.898740E-03	0.596494E-03

COL / ROW	13	14	15	16	17	18
1	-0.108940E-01	0.212992E-01	-0.160720E-03	-0.283782E-01	0.188035E-00	-0.211659E 01
2	0.551002E-02	0.128243E-02	-0.274876E-05	-0.660218E-02	0.161344E-00	-0.205072E 01
3	-0.135510E-01	0.176170E-01	-0.139306E-03	-0.199268E-01	0.621599E-01	-0.612438E 00
4	-0.142329E-02	0.179539E-02	-0.141153E-04	-0.199650E-02	0.433467E-02	-0.335847E-01
5	0.147918E-02	-0.107399E-02	0.877523E-05	0.828567E-03	-0.201973E-04	0.782039E-02
6	-0.728513E-01	0.678332E-01	-0.586231E-03	-0.600566E-01	-0.678403E-01	0.604387E 00
7	0.459403E-01	-0.455491E-01	0.381691E-03	0.427384E-01	0.711533E-02	0.315871E-02
8	-0.564591E-02	0.159257E-01	-0.232029E-03	-0.165150E-01	-0.422565E-01	0.330842E-00
9	0.602852E-02	-0.726791E-02	0.617020E-04	0.763464E-02	-0.756830E-02	0.464966E-01
10	-0.300856E-00	0.343952E-00	-0.294551E-02	-0.350146E-00	0.163332E-00	-0.479994E-00
11	0.288627E-01	-0.600190E-01	0.546937E-03	0.737099E-01	-0.827657E-01	0.218585E-00
12	-0.778237E-02	0.122532E-01	-0.138676E-03	-0.128386E-01	-0.198030E-02	-0.348539E-01
13	0.270149E-02	-0.399119E-02	0.399165E-04	0.430352E-02	-0.175493E-02	0.125223E-01
14	0.126017E-01	-0.145731E-01	0.143988E-03	0.142532E-01	-0.121227E-02	0.424407E-01
15	0.898451E-01	-0.803416E-02	-0.535571E-04	0.713932E-01	-0.508865E-01	-0.184551E-01
16	-0.108372E-00	0.669414E-01	0.441094E-03	0.105844E-00	0.135304E-00	-0.180993E-00
17	0.116542E-00	-0.113336E 01	0.105184E-01	0.505984E 00	0.113890E-00	-0.261176E-01
18	0.467714E-00	0.385369E-01	-0.348923E-02	-0.574230E 00	0.277901E-00	-0.976900E-01
19	0.372050E-01	-0.624420E-02	-0.413315E-03	-0.596118E-01	-0.479258E-01	-0.224988E-01
20	-0.489540E-00	0.109353E-00	0.367542E-02	0.644695E 00	0.350483E-00	-0.369218E-00
21	-0.572395E-01	-0.985879E-01	0.380045E-03	-0.178798E-00	0.318067E-01	0.754186E-04
22	0.286628E-01	-0.369681E-01	-0.297364E-03	-0.129164E-00	0.214035E-00	0.354287E-01
23	-0.625981E-02	0.685466E-03	0.201851E-04	0.124700E-01	-0.569800E-01	-0.105300E-01
24	0.676436E-02	0.176647E-01	-0.199541E-03	0.499576E-01	-0.145135E-00	-0.263536E-01
25	0.385284E-00	-0.613214E-01	-0.289674E-02	-0.225854E-00	-0.324912E-00	0.116523E-00
26	-0.309378E-00	-0.163087E-00	0.308264E 01	-0.401080E-00	0.518963E 00	0.120957E-00
27	-0.671067E-01	-0.216756E-01	-0.219632E-00	-0.529797E-02	-0.981152E-01	-0.140314E-01
28	0.122006E-01	0.136436E-01	-0.576217E-04	0.180106E-01	0.244716E-01	0.560426E-02
29	-0.401604E-01	-0.979776E-01	0.279776E-03	-0.205216E-00	0.250727E-00	0.561452E-01
30	-0.270085E-02	0.135571E-02	0.855355E-05	0.763858E-02	-0.134705E-01	-0.975491E-03

COL / ROW	19	20	21	22	23	24
1	-0.111833E 01	0.359940E-00	0.412710E-00	0.868163E-01	-0.175273E 01	0.273693E-00
2	-0.126628E 01	0.509440E 00	0.985392E 00	0.886394E-01	-0.223852E 01	0.498421E-00
3	-0.248325E-00	0.277561E-01	-0.216770E-00	0.337102E-01	-0.425963E-00	-0.524215E-01
4	-0.589454E-02	-0.496706E-02	-0.347066E-01	0.164312E-02	-0.435658E-02	-0.622182E-02
5	0.828084E-02	-0.325240E-02	-0.665723E-03	-0.165191E-02	0.320784E-01	-0.319451E-02
6	0.124673E-00	0.738032E-01	0.406216E-00	0.100904E-01	-0.675514E 00	0.189951E-00
7	0.267470E-00	-0.377505E-00	-0.201771E 01	0.103046E-00	-0.628411E 00	-0.458261E-00
8	0.128388E-00	0.419800E-01	0.380493E-00	-0.115618E-01	-0.485716E-00	0.687333E 00
9	0.460904E-03	0.774101E-02	0.301953E-01	0.114740E-02	-0.514604E-01	0.278358E-01
10	0.525813E 00	-0.345576E-00	-0.957644E 00	-0.156168E-01	0.569104E-01	0.891751E 00
11	-0.299602E-00	0.134373E-00	0.470973E-01	0.451824E-01	-0.220582E-00	-0.835930E 00
12	0.615215E-02	-0.190944E-02	-0.597474E-02	-0.293006E-02	0.208178E-01	-0.566973E-02
13	-0.578884E-02	0.290721E-02	0.287384E-02	0.128487E-02	-0.991466E-02	-0.118780E-01
14	0.968438E-02	-0.103320E-02	0.115035E-01	0.701449E-03	-0.298762E-01	0.450788E-01
15	-0.150390E-00	0.158565E-01	-0.100051E-00	0.316947E-02	0.109263E-00	0.218582E-00
16	0.399333E-00	-0.148676E-00	0.995165E-01	-0.393371E-01	-0.120286E-01	0.139390E-00
17	0.117811E-01	-0.277884E-01	-0.174830E-01	0.110136E-01	0.198258E-01	0.869388E-01
18	0.261321E-00	-0.224492E-00	0.121999E-00	-0.625288E-01	-0.608519E-01	-0.105631E-00
19	0.454985E-01	0.132137E-01	0.701274E-02	-0.525220E-02	-0.458981E-02	-0.953817E-02
20	0.108732E 01	-0.694215E 00	0.494212E-00	-0.483823E-00	-0.392967E-00	-0.738322E 00
21	0.897005E-01	0.249029E-00	-0.197469E-01	0.250698E-00	0.426614E-02	-0.307136E-01
22	-0.304583E-01	-0.323237E-01	0.103917E-01	0.130643E-00	0.121040E-02	-0.772370E-02
23	0.157109E-01	0.227872E-01	-0.307833E-02	-0.135541E-01	-0.703364E-04	-0.291236E-03
24	0.220406E-01	0.185566E-02	-0.149828E-02	-0.643828E-01	-0.880226E-03	0.402760E-02
25	-0.570222E 00	-0.977100E 00	0.686559E-01	-0.583578E 00	-0.895826E-02	0.458768E-01
26	-0.211799E-00	-0.304451E-00	0.373017E-01	0.129240E-00	0.492159E-03	0.141750E-02
27	0.133274E-01	0.180468E-01	-0.384047E-02	-0.339892E-01	-0.277702E-03	0.576424E-03
28	-0.108421E-01	0.660184E-02	-0.622508E-02	-0.659220E-01	-0.677259E-03	0.282375E-02
29	0.646309E-01	0.781917E 00	-0.184134E-00	-0.936151E 00	-0.619267E-02	0.287236E-02
30	0.303498E-02	0.344727E-01	-0.998173E-02	-0.732868E-01	-0.668544E-03	0.257916E-02

COL / ROW	25	26	27	28	29	30
1	-0.132939E 01	0.158411E-01	-0.137639E-00	0.165022E-01	0.160582E 01	0.192212E 01
2	0.503253E 01	0.403800E-01	0.281150E-00	-0.282869E-01	-0.202397E 01	-0.473894E 01
3	-0.445442E 01	0.626639E 00	0.307545E-00	-0.196938E-01	-0.143413E-00	-0.435737E 01
4	-0.389523E-00	-0.140641E-01	-0.395746E-01	0.404324E-02	0.307147E-00	-0.457218E-00
5	-0.158641E-02	-0.693345E-02	-0.314936E-02	0.152494E-03	-0.101506E-01	-0.505417E-02
6	0.402372E-01	0.908943E 00	0.577447E 00	-0.376144E-01	0.390493E-00	0.120007E-00
7	0.254559E-00	0.342237E-00	0.119115E-00	-0.460218E-02	0.570601E 00	-0.123430E-00
8	-0.117620E-01	-0.463766E-00	-0.142092E-00	0.424297E-02	-0.583501E 00	0.283412E-00
9	-0.243770E-02	-0.363301E-01	-0.221244E-01	0.148928E-02	-0.419715E-01	0.190047E-01
10	-0.798775E-01	-0.133638E 01	-0.639210E 00	0.365475E-01	-0.436812E-00	-0.723230E-01
11	-0.377809E-01	-0.258203E-00	-0.516464E 00	0.437347E-01	-0.169408E-00	0.167696E-02
12	0.954368E-03	-0.294140E-02	0.555319E-02	-0.201099E-02	0.310984E-03	-0.590694E-03
13	-0.935433E-03	-0.460656E-02	-0.976890E-02	0.103761E-02	-0.363626E-02	0.557550E-03
14	-0.548297E-03	0.504602E-02	0.130052E-01	-0.404083E-03	-0.157101E-03	0.382734E-02
15	0.259037E-02	-0.683050E-01	0.215104E-00	-0.203701E-01	0.270326E-01	-0.135436E-03
16	0.246851E-01	0.720501E 00	-0.110130E 01	0.119122E-00	-0.837083E-01	0.340567E-03
17	0.107729E-02	0.324757E-01	-0.477005E-01	0.113282E-01	-0.715359E-02	0.146305E-02
18	-0.626213E-03	-0.215248E-01	0.407402E-01	0.464939E-01	0.649176E-02	-0.129256E-02
19	-0.641213E-04	-0.299136E-02	0.498684E-02	-0.869368E-02	0.900764E-03	-0.138836E-03
20	-0.355307E-01	-0.775048E 00	0.995130E 00	-0.100300E-00	0.571425E-01	-0.174520E-03
21	-0.249628E-02	-0.608735E-01	0.810233E-01	-0.422186E-01	0.553299E-02	-0.765491E-04
22	-0.626598E-03	-0.147552E-01	0.245886E-01	0.748306E-01	0.808586E-03	0.651729E-05
23	0.702274E-05	-0.186524E-03	-0.554122E-03	-0.174802E-01	0.185167E-03	-0.154019E-04
24	0.430047E-03	0.920554E-02	-0.128371E-01	-0.192840E-01	-0.429553E-03	-0.348209E-04
25	0.245786E-02	0.525852E-01	-0.643375E-01	0.370950E-01	-0.389406E-02	0.426113E-04
26	-0.271014E-03	-0.402486E-02	0.150457E-01	0.185141E-00	-0.123521E-02	0.132902E-03
27	0.682804E-04	0.106562E-02	-0.274672E-02	-0.279270E-01	0.170892E-03	-0.204477E-04
28	0.153120E-03	0.304061E-02	-0.225720E-02	0.225231E-01	-0.294124E-03	0.276199E-05
29	-0.983884E-03	-0.735529E-01	0.397071E-00	0.418736E 01	-0.908678E-02	0.162608E-03
30	0.211314E-03	0.873979E-02	-0.394188E-01	-0.398725E-00	0.861160E-03	-0.257887E-04

3. MODE VELOCITIES

MATRIX 30 X 30

COL / ROW	1	2	3	4	5	6
1	-0.129577E-01	0.261488E-00	-0.945315E 02	0.641497E 02	0.256647E 02	-0.246937E 01
2	-0.129577E-01	0.318265E-00	-0.929892E 02	0.625425E 02	0.246667E 02	-0.230596E 01
3	0.536717E-08	-0.359078E-01	-0.708706E 00	0.672503E 00	0.421176E-00	-0.710602E-01
4	0.800060E-09	-0.498403E-02	-0.146750E-00	0.155713E-00	0.983502E-01	-0.166701E-01
5	-0.129577E-01	0.298666E-00	-0.877485E 02	0.560357E 02	0.201092E 02	-0.147378E 01
6	-0.129577E-01	0.275091E-00	-0.485969E 02	0.747577E 01	-0.130167E 02	0.445049E 01
7	0.267692E-08	0.147364E-01	-0.156648E 02	0.194239E 02	0.133864E 02	-0.243071E 01
8	-0.933440E-08	0.285614E-00	-0.245902E 01	0.212260E 01	0.245143E 01	-0.117918E-00
9	-0.163005E-10	0.244073E-02	-0.179913E-00	0.327019E-00	0.214112E-00	-0.557864E-01
10	-0.129577E-01	0.196935E-00	-0.446984E 02	0.104031E-00	-0.183372E 02	0.598582E 01
11	-0.129577E-01	0.113541E 01	-0.199822E 02	-0.130124E 02	-0.318023E 02	0.708214E 01
12	-0.174282E-08	-0.134580E 01	-0.185703E 02	-0.723862E 02	0.166204E 02	-0.267737E 01
13	0.692057E-10	-0.488133E-00	-0.610529E 00	0.121400E 01	-0.207886E 01	0.383946E-00
14	-0.129577E-01	0.105070E 02	-0.135249E 02	-0.760732E 02	0.739632E 01	-0.547570E 00
15	-0.129577E-01	-0.578142E 01	-0.120514E 02	-0.284700E 01	-0.663852E 02	0.128059E 02
16	-0.129577E-01	-0.126808E 02	-0.535382E 01	-0.257597E 01	-0.932641E 02	0.156425E 02
17	0.250847E-08	0.188166E 01	-0.722952E 00	0.146695E 02	0.449198E 01	-0.995608E 00
18	0.252294E-08	0.213330E 01	-0.246778E 01	-0.118599E 02	0.104572E 02	-0.180372E 02
19	0.394836E-09	0.123543E-00	-0.152317E-00	-0.105863E 01	0.108624E 01	0.165338E 01
20	-0.129577E-01	-0.136446E 02	-0.427739E 01	0.336210E 01	-0.100707E 03	0.192174E 02
21	-0.129577E-01	-0.204642E 02	0.279562E 01	-0.807389E 00	-0.984199E 02	0.379424E 02
22	0.149634E-08	0.318973E 01	-0.417479E 01	-0.105358E 01	-0.842174E 02	-0.182326E 03
23	0.336232E-09	0.393501E-00	-0.485599E-00	-0.110397E-00	-0.679479E 01	0.346499E 01
24	-0.129577E-01	-0.267174E 02	0.994781E 01	0.645725E 00	-0.516789E 02	-0.218690E 03
25	-0.129577E-01	-0.205537E 02	0.284234E 01	-0.812880E 00	-0.999823E 02	0.684197E 02
26	-0.156603E-08	-0.170504E 01	0.199124E 01	0.402025E-00	0.151606E 02	-0.124368E 03
27	0.201152E-09	0.285420E-00	-0.334170E-00	-0.682411E-01	-0.279348E 01	0.170469E 02
28	-0.129577E-01	-0.191024E 02	0.445846E-01	-0.184554E 01	-0.238034E 03	0.331831E 03
29	-0.923426E-10	-0.108728E 01	0.194928E 01	0.677261E 00	0.848886E 02	-0.199616E 03
30	0.354012E-10	0.180281E-00	-0.231247E-00	-0.556727E-01	-0.399272E 01	0.978327E 01

COL / ROW	7	8	9	10	11	12
1	0.842072E 02	0.514455E 02	0.113451E 03	-0.265739E 01	-0.642207E 03	0.610123E 03
2	0.729044E 02	0.676938E 02	0.170283E 03	0.110788E 03	-0.304444E 02	0.306263E 03
3	0.556581E 01	-0.104458E 02	-0.391422E 02	-0.851590E 02	-0.489392E 03	0.256238E 03
4	0.111491E 01	-0.128082E 01	-0.437573E 01	-0.948447E 01	-0.546976E 02	0.289833E 02
5	0.376986E 02	0.242081E 02	0.404950E 02	0.221937E 02	0.333559E 02	0.170909E 02
6	-0.228712E 03	-0.212312E 03	-0.741337E 03	-0.668676E 03	-0.969000E 03	-0.823134E 03
7	0.107802E 03	0.114435E 03	0.391422E 03	0.396584E 03	0.875631E 03	0.191071E 03
8	-0.764318E 02	0.189011E 03	0.244217E 03	0.231458E 03	0.231829E 04	-0.200010E 04
9	0.459920E 01	0.147540E 01	0.205979E 02	0.352192E 02	0.103491E 03	0.239479E 01
10	-0.348543E 03	-0.306944E 03	-0.152967E 04	-0.200201E 04	-0.491942E 04	-0.887585E 03
11	-0.282816E 03	-0.316015E 03	-0.649839E 03	-0.220465E 03	-0.201906E 02	-0.205914E 03
12	0.305181E 03	-0.276482E 03	-0.154045E 03	-0.527692E 02	0.119452E 03	-0.282937E 03
13	-0.430618E 02	0.330994E 02	0.155617E 02	0.938753E 01	-0.223178E 02	0.603187E 02
14	-0.104272E 03	0.170841E 03	0.162627E 03	0.893518E 02	-0.106572E 03	0.369661E 03
15	-0.364640E 03	-0.559846E 03	-0.634720E 03	0.142140E 03	0.548426E 03	0.524657E 03
16	-0.251549E 03	-0.577507E 03	-0.708823E 02	0.520674E 03	0.304421E 03	0.337406E 03
17	-0.157029E 03	0.218161E 03	-0.106197E 03	-0.282023E 03	-0.511768E 03	-0.468893E 03
18	0.764988E 02	-0.200898E 03	-0.589179E 02	-0.155313E 04	0.874851E 03	0.629013E 03
19	0.974740E 01	-0.473110E 01	-0.444865E 02	0.263671E 02	0.266402E 02	0.135856E 02
20	-0.318131E 03	-0.574366E 03	0.365649E 02	0.131974E 04	-0.140620E 02	0.177074E 03
21	-0.782981E 02	-0.343092E 03	0.525225E 03	0.354730E 03	-0.236070E 03	-0.206225E 03
22	0.357874E 02	0.769420E 02	-0.207372E 03	0.528750E 03	-0.939866E 02	-0.780835E 02
23	-0.329571E 01	-0.180931E 02	0.454202E 02	-0.471009E 02	-0.233824E 01	-0.288311E 01
24	0.628575E 02	0.124087E 03	-0.101534E 03	-0.740434E 02	0.237201E 02	0.184752E 02
25	-0.102712E 03	-0.507736E 03	0.106932E 04	0.756940E 03	-0.874223E 03	-0.867546E 03
26	0.488933E 02	0.215723E 03	-0.598170E 03	0.534060E 03	0.231755E 03	0.274574E 03
27	-0.640473E 01	-0.255676E 02	0.582061E 02	-0.118891E 03	0.416529E 02	0.442802E 02
28	0.159356E 03	0.266420E 03	-0.213784E 03	-0.520190E 02	0.487065E 02	0.418023E 02
29	-0.137421E 03	-0.351782E 03	0.407571E 03	0.427858E 03	-0.218277E 03	-0.189774E 03
30	0.394868E-00	-0.417000E 01	0.195263E 02	-0.350217E 02	0.265564E 01	0.178486E 01

COL / ROW	13	14	15	16	17	18
1	-0.350654E 02	0.722418E 02	-0.551250E 00	-0.985621E 02	0.817753E 03	-0.982059E 04
2	0.177355E 02	0.434968E 01	-0.942791E-02	-0.229304E 02	0.701674E 03	-0.951497E 04
3	-0.436176E 02	0.597525E 02	-0.477803E-00	-0.692088E 02	0.270329E 03	-0.284160E 04
4	-0.458126E 01	0.608952E 01	-0.484138E-01	-0.693416E 01	0.188512E 02	-0.155827E 03
5	0.476112E 01	-0.364271E 01	0.300979E-01	0.287774E 01	-0.878366E-01	0.362852E 02
6	-0.234491E 03	0.230074E 03	-0.201070E 01	-0.208586E 03	-0.295033E 03	0.280425E 04
7	0.147871E 03	-0.154491E 03	0.130915E 01	0.148437E 03	0.309441E 02	0.146559E 02
8	-0.181729E 02	0.540163E 02	-0.795830E 00	-0.573590E 02	-0.183771E 03	0.153505E 04
9	0.194044E 02	-0.246510E 02	0.211630E-00	0.265163E 02	-0.329140E 02	0.215736E 03
10	-0.968385E 03	0.116660E 04	-0.101027E 02	-0.121611E 04	0.710321E 03	-0.222709E 04
11	0.929023E 02	-0.203570E 03	0.187592E 01	0.256006E 03	-0.359943E 03	0.101419E 04
12	-0.250497E 02	0.415598E 02	-0.475640E-00	-0.445904E 02	-0.861219E 01	-0.161716E 03
13	0.869546E 01	-0.135371E 02	0.136909E-00	0.149468E 02	-0.763207E 01	0.581015E 02
14	0.405620E 02	-0.494284E 02	0.493862E-00	0.495038E 02	-0.527206E 01	0.196918E 03
15	0.289191E 03	-0.272499E 02	-0.183694E-00	0.247960E 03	-0.221302E 03	-0.856284E 02
16	-0.348823E 03	0.227049E 03	0.151290E 01	0.367611E 03	0.588428E 03	-0.839777E 03
17	0.375122E 03	-0.384410E 04	0.360768E 02	0.175736E 04	0.495299E 03	-0.121181E 03
18	0.150546E 04	0.130708E 03	-0.119676E 02	-0.199439E 04	0.120857E 04	-0.453265E 03
19	0.119754E 03	-0.211788E 02	-0.141762E 01	-0.207041E 03	-0.208426E 03	-0.104391E 03
20	-0.157572E 04	0.370900E 03	0.126062E 02	0.223913E 04	0.152423E 04	-0.171311E 04
21	-0.184241E 03	-0.334386E 03	0.130351E 01	-0.620994E 03	0.138325E 03	0.349929E-00
22	0.922590E 02	-0.125387E 03	-0.101992E 01	-0.448607E 03	0.930823E 03	0.164383E 03
23	-0.201489E 02	0.232494E 01	0.692324E-01	0.433101E 02	-0.247802E 03	-0.488575E 02
24	0.217729E 02	0.599144E 02	-0.684401E 00	0.173510E 03	-0.631181E 03	-0.122276E 03
25	0.124014E 04	-0.207987E 03	-0.993547E 01	-0.784426E 03	-0.141302E 04	0.540646E 03
26	-0.995818E 03	-0.553152E 03	0.105731E 05	-0.139301E 04	0.225693E 04	0.561220E 03
27	-0.216001E 03	-0.735185E 02	-0.753311E 03	-0.184007E 02	-0.426696E 03	-0.651032E 02
28	0.392708E 02	0.462757E 02	-0.197635E-00	0.625536E 02	0.106425E 03	0.260028E 02
29	-0.129267E 03	-0.332316E 03	0.959595E 00	-0.712746E 03	0.109039E 04	0.260504E 03
30	-0.869341E 01	0.459825E 01	0.293376E-01	0.265300E 02	-0.585823E 02	-0.452611E 01

COL / ROW	19	20	21	22	23	24
1	-0.555417E 04	0.189630E 04	0.224304E 04	0.499369E 03	-0.104647E 05	0.185690E 04
2	-0.628896E 04	0.268392E 04	0.535552E 04	0.509855E 03	-0.133651E 05	0.338159E 04
3	-0.123330E 04	0.146229E 03	-0.117812E 04	0.193902E 03	-0.254321E 04	-0.355658E 03
4	-0.292751E 02	-0.261683E 02	-0.188627E 03	0.945127E 01	-0.260109E 02	-0.422125E 02
5	0.411266E 02	-0.171348E 02	-0.361815E 01	-0.950184E 01	0.191524E 03	-0.216734E 02
6	0.619185E 03	0.388822E 03	0.220775E 04	0.580401E 02	-0.403315E 04	0.128874E 04
7	0.132838E 04	-0.198884E 04	-0.109661E 05	0.592724E 03	-0.375192E 04	-0.310911E 04
8	0.637635E 03	0.221166E 03	0.206795E 04	-0.665037E 02	-0.289996E 04	0.466328E 04
9	0.228907E 01	0.407825E 02	0.164109E 03	0.659984E 01	-0.307244E 03	0.188854E 03
10	0.261144E 04	-0.182062E 04	-0.520471E 04	-0.898279E 02	0.339783E 03	0.605017E 04
11	-0.148797E 04	0.707929E 03	0.255969E 03	0.259890E 03	-0.131699E 04	-0.567144E 04
12	0.305545E 02	-0.100596E 02	-0.324722E 02	-0.168537E 02	0.124293E 03	-0.384668E 02
13	-0.287501E 02	0.153163E 02	0.156190E 02	0.739062E 01	-0.591954E 02	-0.805874E 02
14	0.480972E 02	-0.544329E 01	0.625203E 02	0.403474E 01	-0.178376E 03	0.305841E 03
15	-0.746907E 03	0.835379E 02	-0.543770E 03	0.182309E 02	0.652357E 03	0.148299E 04
16	0.198328E 04	-0.783280E 03	0.540864E 03	-0.226268E 03	-0.718167E 02	0.945705E 03
17	0.585108E 02	-0.146400E 03	-0.950183E 02	0.633502E 02	0.118370E 03	0.589844E 03
18	0.129784E 04	-0.118271E 04	0.663054E 03	-0.359667E 03	-0.363316E 03	-0.716666E 03
19	0.225967E 03	0.696145E 02	0.381136E 02	-0.302107E 02	-0.274034E 02	-0.647126E 02
20	0.540013E 04	-0.365738E 04	0.268600E 04	-0.278296E 04	-0.234621E 04	-0.500922E 04
21	0.445496E 03	0.131197E 04	-0.107323E 03	0.144202E 04	0.254710E 02	-0.208379E 03
22	-0.151270E 03	-0.170293E 03	0.564781E 02	0.751458E 03	0.722666E 01	-0.524021E 02
23	0.780277E 02	0.120051E 03	-0.167305E 02	-0.779635E 02	-0.419943E-00	-0.197592E 01
24	0.109464E 03	0.977631E 01	-0.814300E 01	-0.370331E 03	-0.525539E 01	0.273256E 02
25	-0.283199E 04	-0.514772E 04	0.373139E 03	-0.335675E 04	-0.534852E 02	0.311255E 03
26	-0.105189E 04	-0.160396E 04	0.202731E 03	0.743390E 03	0.293843E 01	0.961717E 01
27	0.661900E 02	0.950772E 02	-0.208726E 02	-0.195506E 03	-0.165802E 01	0.391080E 01
28	-0.538469E 02	0.347809E 02	-0.338327E 02	-0.379184E 03	-0.404357E 01	0.191580E 02
29	0.320988E 03	0.411942E 04	-0.100075E 04	-0.538476E 04	-0.369733E 02	0.194878E 02
30	0.150732E 02	0.181615E 03	-0.542498E 02	-0.421547E 03	-0.399154E 01	0.174986E 02

COL / ROW	25	26	27	28	29	30
1	-0.114210E 05	0.152162E 03	-0.143515E 04	0.178149E 03	0.198657E 05	0.453307E 05
2	0.432353E 05	0.387872E 03	0.293152E 04	-0.305370E 03	-0.250385E 05	-0.111762E 06
3	-0.382686E 05	0.601922E 04	0.320675E 04	-0.212604E 03	-0.177416E 04	-0.102763E 06
4	-0.334645E 04	-0.135094E 03	-0.412641E 03	0.436486E 02	0.379972E 04	-0.107829E 05
5	-0.136291E 02	-0.665997E 02	-0.328381E 02	0.164624E 01	-0.125573E 03	-0.119196E 03
6	0.345684E 03	0.873091E 04	0.602099E 04	-0.406065E 03	0.483078E 04	0.283021E 04
7	0.218696E 04	0.328738E 04	0.124200E 04	-0.496826E 02	0.705890E 04	-0.291094E 04
8	-0.101049E 03	-0.445474E 04	-0.148158E 04	0.458049E 02	-0.721850E 04	0.668388E 04
9	-0.209426E 02	-0.348971E 03	-0.230689E 03	0.160774E 02	-0.519230E 03	0.448201E 03
10	-0.686241E 03	-0.128367E 05	-0.666500E 04	0.394547E 03	-0.540380E 04	-0.170564E 04
11	-0.324582E 03	-0.248019E 04	-0.538513E 04	0.472136E 03	-0.209575E 04	0.395489E 02
12	0.819913E 01	-0.282538E 02	0.579027E 02	-0.217095E 02	0.384719E 01	-0.139307E 02
13	-0.803646E 01	-0.442486E 02	-0.101860E 03	0.112015E 02	-0.449842E 02	0.131491E 02
14	-0.471051E 01	0.484699E 02	0.135604E 03	-0.436226E 01	-0.194350E 01	0.902626E 02
15	0.222543E 02	-0.656109E 03	0.224287E 04	-0.219904E 03	0.334421E 03	-0.319407E 01
16	0.212073E 03	0.692083E 04	-0.114831E 05	0.128598E 04	-0.103556E 04	0.803183E 01
17	0.925518E 01	0.311947E 03	-0.497370E 03	0.122293E 03	-0.884970E 02	0.345041E 02
18	-0.537989E 01	-0.206758E 03	0.424795E 03	0.501923E 03	0.803096E 02	-0.304833E 02
19	-0.550876E 00	-0.287337E 02	0.519974E 02	-0.938523E 02	0.111434E 02	-0.327426E 01
20	-0.305250E 03	-0.744478E 04	0.103761E 05	-0.108278E 04	0.706910E 03	-0.411583E 01
21	-0.214459E 02	-0.584725E 03	0.844824E 03	-0.455770E 03	0.684486E 02	-0.180531E 01
22	-0.538321E 01	-0.141732E 03	0.256383E 03	0.807831E 03	0.100030E 02	0.153702E-00
23	0.603335E-01	-0.179167E 01	-0.577779E 01	-0.188707E 03	0.229071E 01	-0.363234E-00
24	0.369460E 01	0.884245E 02	-0.133851E 03	-0.208180E 03	-0.531400E 01	-0.821204E 00
25	0.211158E 02	0.505111E 03	-0.670842E 03	0.400457E 03	-0.481734E 02	0.100493E 01
26	-0.232832E 01	-0.386611E 02	0.156880E 03	0.199868E 04	-0.152808E 02	0.313432E 01
27	0.586608E 00	0.102358E 02	-0.286398E 02	-0.301484E 03	0.211410E 01	-0.482232E-00
28	0.131548E 01	0.292068E 02	-0.235357E 02	0.243147E 03	-0.363861E 01	0.651378E-01
29	-0.845271E 01	-0.706517E 03	0.414022E 04	0.452045E 05	-0.112413E 03	0.383488E 01
30	0.181544E 01	0.839506E 02	-0.411017E 03	-0.430442E 04	0.106534E 02	-0.608191E 00

4. MODE ACCELERATIONS

MATRIX 30 X 30

COL / ROW	1	2	3	4	5	6
1	0.207129E-02	-0.618842E 02	0.356359E 05	-0.335006E 05	-0.185141E 05	0.274972E 04
2	0.207129E-02	-0.753210E 02	0.350545E 05	-0.326613E 05	-0.177941E 05	0.256776E 04
3	-0.857941E-09	0.849800E 01	0.267164E 03	-0.351198E 03	-0.303829E 03	0.791278E 02
4	-0.127889E-09	0.117953E 01	0.553208E 02	-0.813175E 02	-0.709483E 02	0.185627E 02
5	0.207129E-02	-0.706827E 02	0.330789E 05	-0.292633E 05	-0.145064E 05	0.164110E 04
6	0.207129E-02	-0.651034E 02	0.183198E 05	-0.390404E 04	0.939005E 04	-0.495577E 04
7	-0.427905E-09	-0.348753E 01	0.590524E 04	-0.101437E 05	-0.965671E 04	0.270668E 04
8	0.149210E-08	-0.675938E 02	0.926989E 03	-0.110848E 04	-0.176842E 04	0.131306E 03
9	0.260562E-11	-0.577626E 00	0.678224E 02	-0.170778E 03	-0.154457E 03	0.621200E 02
10	0.207129E-02	-0.466069E 02	0.168501E 05	-0.543277E 02	0.132282E 05	-0.666541E 04
11	0.207129E-02	-0.268708E 03	0.753276E 04	0.679543E 04	0.229417E 05	-0.788620E 04
12	0.278590E-09	0.318499E 03	0.700053E 04	0.378019E 05	-0.119897E 05	0.298133E 04
13	-0.110625E-10	0.115522E 03	0.230154E 03	-0.633980E 03	0.149965E 04	-0.427536E 03
14	0.207129E-02	-0.248661E 04	0.509852E 04	0.397273E 05	-0.533559E 04	0.609737E 03
15	0.207129E-02	0.136824E 04	0.454308E 04	0.148677E 04	0.478892E 05	-0.142598E 05
16	0.207129E-02	0.300105E 04	0.201825E 04	0.134524E 04	0.672792E 05	-0.174185E 05
17	-0.400979E-09	-0.445317E 03	0.272534E 03	-0.766079E 04	-0.324044E 04	0.110864E 04
18	-0.403291E-09	-0.504869E 03	0.930291E 03	0.619354E 04	-0.754363E 04	0.200850E 05
19	-0.631145E-10	-0.292380E 02	0.574195E 02	0.552842E 03	-0.783598E 03	-0.184109E 04
20	0.207129E-02	0.322916E 04	0.161246E 04	-0.175578E 04	0.726484E 05	-0.213992E 05
21	0.207129E-02	0.484308E 04	-0.105388E 04	0.421639E 03	0.709985E 05	-0.422501E 05
22	-0.239189E-09	-0.754886E 03	0.157379E 04	0.550208E 03	0.607531E 05	0.203026E 06
23	-0.537466E-10	-0.931266E 02	0.183058E 03	0.576524E 02	0.490165E 04	-0.385838E 04
24	0.207129E-02	0.632298E 04	-0.375007E 04	-0.337214E 03	0.372803E 05	0.243519E 06
25	0.207129E-02	0.486427E 04	-0.107149E 04	0.424506E 03	0.721256E 05	-0.761876E 05
26	0.250330E-09	0.403516E 03	-0.750645E 03	-0.209948E 03	-0.109366E 05	0.138488E 06
27	-0.321541E-10	-0.675479E 02	0.125973E 03	0.356373E 02	0.201517E 04	-0.189822E 05
28	0.207129E-02	0.452080E 04	-0.168073E 02	0.963790E 03	0.171714E 06	-0.369505E 06
29	0.147609E-10	0.257316E 03	-0.734829E 03	-0.353683E 03	-0.612373E 05	0.222279E 06
30	-0.565887E-11	-0.426656E 02	0.871743E 02	0.290737E 02	0.288028E 04	-0.108940E 05

COL / ROW	7	8	9	10	11	12
1	-0.119298E 06	-0.938279E 05	-0.268269E 06	0.751911E 04	0.189763E 07	-0.182564E 07
2	-0.103285E 06	-0.123462E 06	-0.402653E 06	-0.313475E 06	0.899588E 05	-0.916413E 06
3	-0.788519E 04	0.190514E 05	0.925562E 05	0.240958E 06	0.144608E 07	-0.766727E 06
4	-0.157951E 04	0.233601E 04	0.103469E 05	0.268364E 05	0.161623E 06	-0.867251E 05
5	-0.534084E 05	-0.441515E 05	-0.957550E 05	-0.627974E 05	-0.985618E 05	-0.511402E 05
6	0.324021E 06	0.387222E 06	0.175298E 07	0.189203E 07	0.286325E 07	0.246302E 07
7	-0.152725E 06	-0.208709E 06	-0.925563E 06	-0.112214E 07	-0.258736E 07	-0.571731E 06
8	0.108282E 06	-0.344724E 06	-0.577480E 06	-0.654915E 06	-0.685022E 07	0.598480E 07
9	-0.651577E 04	-0.269088E 04	-0.487060E 05	-0.996533E 05	-0.305801E 06	-0.716579E 04
10	0.493788E 06	0.559813E 06	0.361707E 07	0.566470E 07	0.145362E 08	0.265587E 07
11	0.400671E 06	0.576359E 06	0.153662E 07	0.623810E 06	0.596604E 05	0.616145E 06
12	-0.432355E 06	0.504257E 06	0.364258E 06	0.149311E 06	-0.352964E 06	0.846618E 06
13	0.610065E 05	-0.603677E 05	-0.367975E 05	-0.265621E 05	0.659458E 05	-0.180489E 06
14	0.147724E 06	-0.311584E 06	-0.384551E 06	-0.252822E 06	0.314903E 06	-0.110612E 07
15	0.516593E 06	0.102106E 07	0.150087E 07	-0.402186E 06	-0.162052E 07	-0.156990E 07
16	0.356375E 06	0.105328E 07	0.167609E 06	-0.147326E 07	-0.899519E 06	-0.100960E 07
17	0.222466E 06	-0.397889E 06	0.251116E 06	0.797988E 06	0.151220E 07	0.140304E 07
18	-0.108377E 06	0.366405E 06	0.139318E 06	0.439461E 07	-0.258506E 07	-0.188216E 07
19	-0.138093E 05	0.862873E 04	0.105193E 06	-0.746060E 05	-0.787178E 05	-0.406516E 05
20	0.450702E 06	0.104755E 07	-0.864620E 05	-0.373423E 07	0.415511E 05	-0.529850E 06
21	0.110926E 06	0.625742E 06	-0.124195E 07	-0.100371E 07	0.697552E 06	0.617076E 06
22	-0.507008E 05	-0.140329E 06	0.490355E 06	-0.149610E 07	0.277717E 06	0.233645E 06
23	0.466910E 04	0.329988E 05	-0.107401E 06	0.133273E 06	0.690917E 04	0.862699E 04
24	-0.890515E 05	-0.226313E 06	0.240088E 06	0.209507E 06	-0.700894E 05	-0.552825E 05
25	0.145514E 06	0.926024E 06	-0.252853E 07	-0.214177E 07	0.258320E 07	0.259591E 07
26	-0.692680E 05	-0.393442E 06	0.141444E 07	-0.151113E 07	-0.684802E 06	-0.821592E 06
27	0.907370E 04	0.466310E 05	-0.137635E 06	0.336403E 06	-0.123078E 06	-0.132497E 06
28	-0.225763E 06	-0.485905E 06	0.505516E 06	0.147188E 06	-0.143921E 06	-0.125083E 06
29	0.194687E 06	0.641592E 06	-0.963749E 06	-0.121063E 07	0.644977E 06	0.567849E 06
30	-0.559417E 03	0.760538E 04	-0.461722E 05	0.990944E 05	-0.784704E 04	-0.534074E 04

COL / ROW	13	14	15	16	17	18
1	0.112867E 06	-0.245027E 06	0.189072E 04	0.342321E 06	-0.355635E 07	0.455658E 08
2	-0.570864E 05	-0.147531E 05	0.323365E 02	0.796409E 05	-0.305153E 07	0.441478E 08
3	0.140395E 06	-0.202666E 06	0.163881E 04	0.240373E 06	-0.117564E 07	0.131845E 08
4	0.147460E 05	-0.206542E 05	0.166053E 03	0.240834E 05	-0.819825E 05	0.723011E 06
5	-0.153250E 05	0.123552E 05	-0.103232E 03	-0.999485E 04	0.381995E 03	-0.168357E 06
6	0.754774E 06	-0.780355E 06	0.689644E 04	0.724452E 06	0.128308E 07	-0.130112E 08
7	-0.475963E 06	0.523997E 06	-0.449023E 04	-0.515545E 06	-0.134574E 06	-0.680007E 05
8	0.584944E 05	-0.183210E 06	0.272960E 04	0.199217E 06	0.799206E 06	-0.712237E 07
9	-0.624583E 05	0.836102E 05	-0.725865E 03	-0.920952E 05	0.143141E 06	-0.100098E 07
10	0.311701E 07	-0.395683E 07	0.346511E 05	0.422375E 07	-0.308914E 07	0.103333E 08
11	-0.299031E 06	0.690460E 06	-0.643419E 04	-0.889149E 06	0.156537E 07	-0.470569E 07
12	0.806291E 05	-0.140961E 06	0.163138E 04	0.154869E 06	0.374538E 05	0.750334E 06
13	-0.279887E 05	0.459147E 05	-0.469579E 03	-0.519126E 05	0.331914E 05	-0.269581E 06
14	-0.130560E 06	0.167649E 06	-0.169389E 04	-0.171934E 06	0.229278E 05	-0.913663E 06
15	-0.930839E 06	0.924251E 05	0.630048E 03	-0.861202E 06	0.962426E 06	0.397301E 06
16	0.112278E 07	-0.770095E 06	-0.518905E 04	-0.127677E 07	-0.255903E 07	0.389642E 07
17	-0.120743E 07	0.130382E 08	-0.123739E 06	-0.610359E 07	-0.215402E 07	0.562259E 06
18	-0.484574E 07	-0.443329E 06	0.410475E 05	0.692682E 07	-0.525601E 07	0.210307E 07
19	-0.385462E 06	0.718334E 05	0.486226E 04	0.719086E 06	0.906430E 06	0.484354E 06
20	0.507187E 07	-0.125800E 07	-0.432378E 05	-0.777684E 07	-0.662876E 07	0.794852E 07
21	0.593029E 06	0.113416E 07	-0.447087E 04	0.215681E 07	-0.601567E 06	-0.162361E 04
22	-0.296961E 06	0.425282E 06	0.349820E 04	0.155808E 07	-0.404808E 07	-0.762707E 06
23	0.648546E 05	-0.788562E 04	-0.237459E 03	-0.150423E 06	0.107767E 07	0.226691E 06
24	-0.700820E 05	-0.203215E 06	0.234741E 04	-0.602629E 06	0.274496E 07	0.567339E 06
25	-0.399172E 07	0.705442E 06	0.340774E 05	0.272443E 07	0.614513E 07	-0.250850E 07
26	0.320531E 07	0.187616E 07	-0.362643E 08	0.483815E 07	-0.981525E 07	-0.260396E 07
27	0.695258E 06	0.249357E 06	0.258376E 07	0.639084E 05	0.185567E 07	0.302067E 06
28	-0.126404E 06	-0.156956E 06	0.677864E 03	-0.217258E 06	-0.462837E 06	-0.120648E 06
29	0.416081E 06	0.112714E 07	-0.329129E 04	0.247548E 07	-0.474205E 07	-0.120869E 07
30	0.279821E 05	-0.155961E 05	-0.100624E 03	-0.921427E 05	0.254770E 06	0.210004E 05

COL / ROW	19	20	21	22	23	24
1	0.275846E 08	-0.999039E 07	-0.121907E 08	-0.287238E 07	0.624794E 08	-0.125983E 08
2	0.312340E 08	-0.141398E 08	-0.291068E 08	-0.293269E 07	0.797962E 08	-0.229427E 08
3	0.612515E 07	-0.770389E 06	0.640300E 07	-0.111532E 07	0.151842E 08	0.241300E 07
4	0.145394E 06	0.137864E 06	0.102517E 07	-0.543638E 05	0.155298E 06	0.286395E 06
5	-0.204254E 06	0.902725E 05	0.196643E 05	0.546547E 05	-0.114349E 07	0.147045E 06
6	-0.307517E 07	-0.204846E 07	-0.119989E 08	-0.333848E 06	0.240799E 08	-0.874357E 07
7	-0.659738E 07	0.104779E 08	0.595998E 08	-0.340936E 07	0.224008E 08	0.210941E 08
8	-0.316680E 07	-0.116518E 07	-0.112391E 08	0.382530E 06	0.173142E 08	-0.316384E 08
9	-0.113686E 05	-0.214857E 06	-0.891917E 06	-0.379624E 05	0.183440E 07	-0.128130E 07
10	-0.129697E 08	0.959169E 07	0.282871E 08	0.516692E 06	-0.202867E 07	-0.410479E 08
11	0.738995E 07	-0.372963E 07	-0.139117E 07	-0.149489E 07	0.786306E 07	0.384784E 08
12	-0.151748E 06	0.529978E 05	0.176484E 06	0.969429E 05	-0.742089E 06	0.260982E 06
13	0.142787E 06	-0.806917E 05	-0.848881E 05	-0.425109E 05	0.353426E 06	0.546753E 06
14	-0.238874E 06	0.286773E 05	-0.339792E 06	-0.232079E 05	0.106499E 07	-0.207501E 07
15	0.370949E 07	-0.440108E 06	0.295534E 07	-0.104864E 06	-0.389489E 07	-0.100615E 08
16	-0.984991E 07	0.412661E 07	-0.293955E 07	0.130150E 07	0.428781E 06	-0.641623E 07
17	-0.290592E 06	0.771287E 06	0.516416E 06	-0.364391E 06	-0.706727E 06	-0.400185E 07
18	-0.644571E 07	0.623093E 07	-0.360364E 07	0.206881E 07	0.216918E 07	0.486229E 07
19	-0.112226E 07	-0.366755E 06	-0.207144E 06	0.173773E 06	0.163612E 06	0.439049E 06
20	-0.268196E 08	0.192684E 08	-0.145982E 08	0.160076E 08	0.140080E 08	0.339855E 08
21	-0.221254E 07	-0.691196E 07	0.583290E 06	-0.829451E 07	-0.152074E 06	0.141377E 07
22	0.751280E 06	0.897167E 06	-0.306953E 06	-0.432240E 07	-0.431467E 05	0.355527E 06
23	-0.387523E 06	-0.632475E 06	0.909287E 05	0.448448E 06	0.250727E 04	0.134058E 05
24	-0.543652E 06	-0.515052E 05	0.442565E 05	0.213015E 07	0.313773E 05	-0.185393E 06
25	0.140650E 08	0.271201E 08	-0.202798E 07	0.193081E 08	0.319333E 06	-0.211174E 07
26	0.522421E 07	0.845025E 07	-0.110183E 07	-0.427599E 07	-0.175439E 05	-0.652486E 05
27	-0.328731E 06	-0.500902E 06	0.113441E 06	0.112455E 07	0.989919E 04	-0.265332E 05
28	0.267430E 06	-0.183239E 06	0.183878E 06	0.218107E 07	0.241421E 05	-0.129979E 06
29	-0.159418E 07	-0.217026E 08	0.543901E 07	0.309732E 08	0.220749E 06	-0.132217E 06
30	-0.748605E 05	-0.956814E 06	0.294843E 06	0.242474E 07	0.238315E 05	-0.118721E 06

COL / ROW	25	26	27	28	29	30
1	0.981196E 08	-0.146161E 07	0.149642E 08	-0.192320E 07	-0.245758E 09	-0.106906E 10
2	-0.371441E 09	-0.372573E 07	-0.305668E 08	0.329661E 07	0.309752E 09	0.263575E 10
3	0.328772E 09	-0.578181E 08	-0.334365E 08	0.229516E 07	0.219481E 08	0.242352E 10
4	0.287499E 08	0.129765E 07	0.430258E 07	-0.471207E 06	-0.470064E 08	0.254300E 09
5	0.117090E 06	0.639728E 06	0.342400E 06	-0.177719E 05	0.155346E 07	0.281107E 07
6	-0.296983E 07	-0.838654E 08	-0.627804E 08	0.438365E 07	-0.597617E 08	-0.667468E 08
7	-0.187885E 08	-0.315772E 08	-0.129502E 08	0.536347E 06	-0.873257E 08	0.686506E 08
8	0.868132E 06	0.427903E 08	0.154483E 08	-0.494484E 06	0.893001E 08	-0.157630E 09
9	0.179922E 06	0.335207E 07	0.240538E 07	-0.173563E 06	0.642339E 07	-0.105702E 08
10	0.589560E 07	0.123304E 09	0.694954E 08	-0.425931E 07	0.668505E 08	0.402253E 08
11	0.278854E 07	0.238236E 08	0.561503E 08	-0.509692E 07	0.259265E 08	-0.932708E 06
12	-0.704401E 05	0.271394E 06	-0.603747E 06	0.234364E 06	-0.475936E 05	0.328538E 06
13	0.690425E 05	0.425033E 06	0.106208E 07	-0.120925E 06	0.556500E 06	-0.310103E 06
14	0.404687E 05	-0.465581E 06	-0.141393E 07	0.470926E 05	0.240430E 05	-0.212872E 07
15	-0.191190E 06	0.630230E 07	-0.233863E 08	0.237397E 07	-0.413712E 07	0.753279E 05
16	-0.182196E 07	-0.664785E 08	0.119734E 09	-0.138827E 08	0.128109E 08	-0.189420E 06
17	-0.795127E 05	-0.299643E 07	0.518604E 07	-0.132021E 07	0.109480E 07	-0.813733E 06
18	0.462195E 05	0.198603E 07	-0.442931E 07	-0.541849E 07	-0.993511E 06	0.718907E 06
19	0.473266E 04	0.276004E 06	-0.542173E 06	0.101318E 07	-0.137854E 06	0.772190E 05
20	0.262245E 07	0.715113E 08	-0.108191E 09	0.116891E 08	-0.874518E 07	0.970662E 05
21	0.184245E 06	0.561661E 07	-0.880891E 07	0.492024E 07	-0.846778E 06	0.425758E 05
22	0.462480E 05	0.136142E 07	-0.267329E 07	-0.872090E 07	-0.123747E 06	-0.362485E 04
23	-0.518335E 03	0.172100E 05	0.602446E 05	0.203718E 07	-0.283383E 05	0.856639E 04
24	-0.317409E 05	-0.849367E 06	0.139566E 07	0.224739E 07	0.657395E 05	0.193670E 05
25	-0.181410E 06	-0.485188E 07	0.699482E 07	-0.432312E 07	0.595954E 06	-0.236999E 05
26	0.200030E 05	0.371362E 06	-0.163578E 07	-0.215767E 08	0.189039E 06	-0.739187E 05
27	-0.503964E 04	-0.983211E 05	0.298625E 06	0.325466E 07	-0.261536E 05	0.113728E 05
28	-0.113015E 05	-0.280548E 06	0.245405E 06	-0.262488E 07	0.450132E 05	-0.153619E 04
29	0.726186E 05	0.678650E 07	-0.431698E 08	-0.488003E 09	0.139066E 07	-0.904406E 05
30	-0.155967E 05	-0.806394E 06	0.428564E 07	0.464682E 08	-0.131793E 06	0.143434E 05

```
1834 LINES OUTPUT.
    $STOP       JOB IS COMPLETE


     PERIPHERAL UNIT POSITIONS AT END OF JOBS

     SYSPP1   IS    B3     REC. 00001, FILE 00000
     SYSOU1   IS    A2     REC. 00383, FILE 00000
     SYSIN1   IS    A3     REC. 00003, FILE 00002

    END OF JOBS
```

VII. REFERENCES

1. 5268-6002-RU000, Improved Analytic Longitudinal Response Analysis for Axisymmetric Launch Vehicles, Volume I Linear Analytical Model, by C. P. Rubin.

NASA CR-346

IMPROVED ANALYTIC LONGITUDINAL RESPONSE ANALYSIS FOR AXISYMMETRIC LAUNCH VEHICLES

VOLUME II - COMPUTER PROGRAM DESCRIPTION

By C. P. Rubin and T. T. Wang

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